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AVIATION

The Older International Aeronautical Magazine

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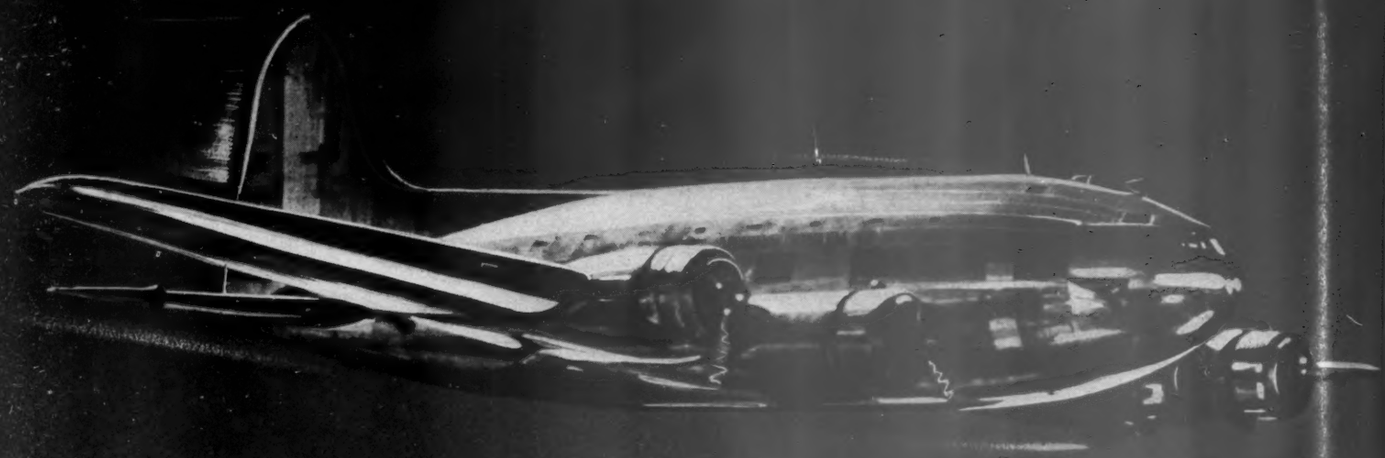

PAA

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● This year will mark a brilliant new era in air transportation when Pan American Airways begins the world's first regular substratosphere flights between the United States and South America. Three days to Rio, four to Buenos Aires, Pan American's new Boeing 307's with their sealed cabins will shrink by two full days the present schedules.

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AVIATION

THE OLDEST AMERICAN AERONAUTICAL MAGAZINE

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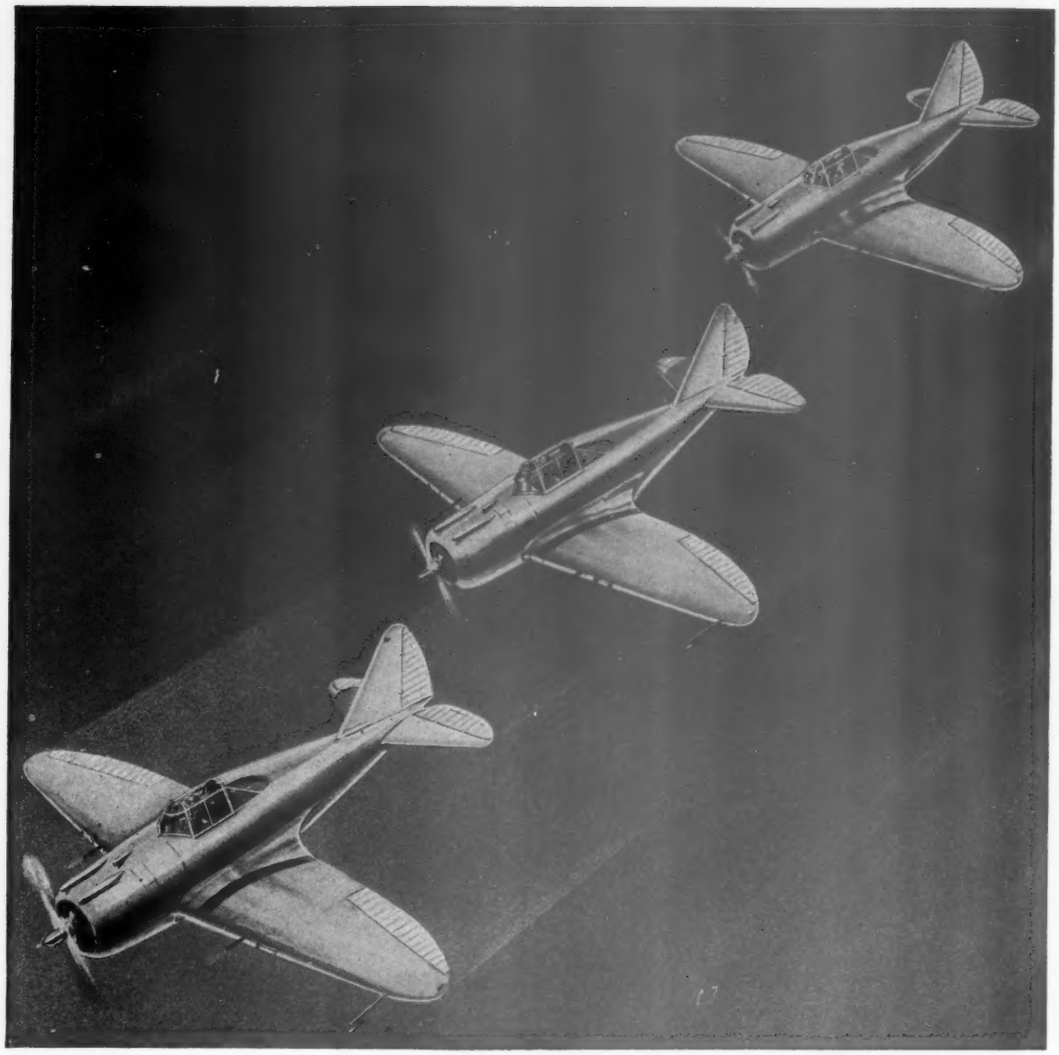


REPUBLIC AVIATION

19 PLANES IN 22 DAYS! . . . Last month, 19 first-line combat planes—checked to the last detail of equipment and flight-tested with full armament—moved from the Republic Aviation plant to purchasers. Republic's emphasis on Man Power—men selected for character, ability and skill, in an efficient and harmonious organization—keeps production moving on schedule, results in on-time deliveries . . .

Republic is ready—for today's job and tomorrow's!

REPUBLIC AVIATION CORPORATION

Former name—Seversky Aircraft Corp. • FARMINGDALE, LONG ISLAND, N.Y.

Flashes

Picked Up Along Editorial Airways

Needed—A Program for Defense

» THE THREE-DIMENSIONAL MILITARY OPERATIONS of the last few weeks have shocked the entire world. To those of us who are familiar with the airplane and its potentialities, they are no great surprise. We have foreseen and frequently foretold these terrible events. But the layman who has been slow to realize their import has suddenly discovered their significance. As a result, his spokesmen in the Congress are in full accord with the President's proposal to build up our defenses.

The President has asked for a production capacity of 50,000 airplanes annually and for trained men to fly them. He has made no mention of what types of planes he wants or when he wants them. Until some time limit is set, such a request has little meaning.

We cannot afford to ignore the experience of the British and the French in their efforts to build large quantities of aircraft in a hurry. It required several years for the British "shadow plant" system of production to reach the generally conceded capacity of 1200 planes per month and that estimate may be a generous one. The French industry has never fully recovered from the attempts at nationalization made several years ago.

We are more fortunate than other nations in having a large reservoir of skilled mechanics and machine tool operators. But no matter how skillful these men may be, they will need additional training to fit them for the exacting requirements of aviation work.

And we cannot operate our aircraft from country roads or city streets. We must have bases and more bases and adequate housing facilities at a time when airports are too few and hangar space is at a premium.

At the present time we have 23 plants at work on military flying equipment and an equal number doing non-military work. Obviously some of the latter can be put to work as subcontractors for the others. But we must not destroy the commercial aircraft industry. Our magnificent air transport system would be an invaluable asset in our preparation for defense. At this very moment it is faced with an equipment shortage. We cannot afford to impair its usefulness to a defensive program.

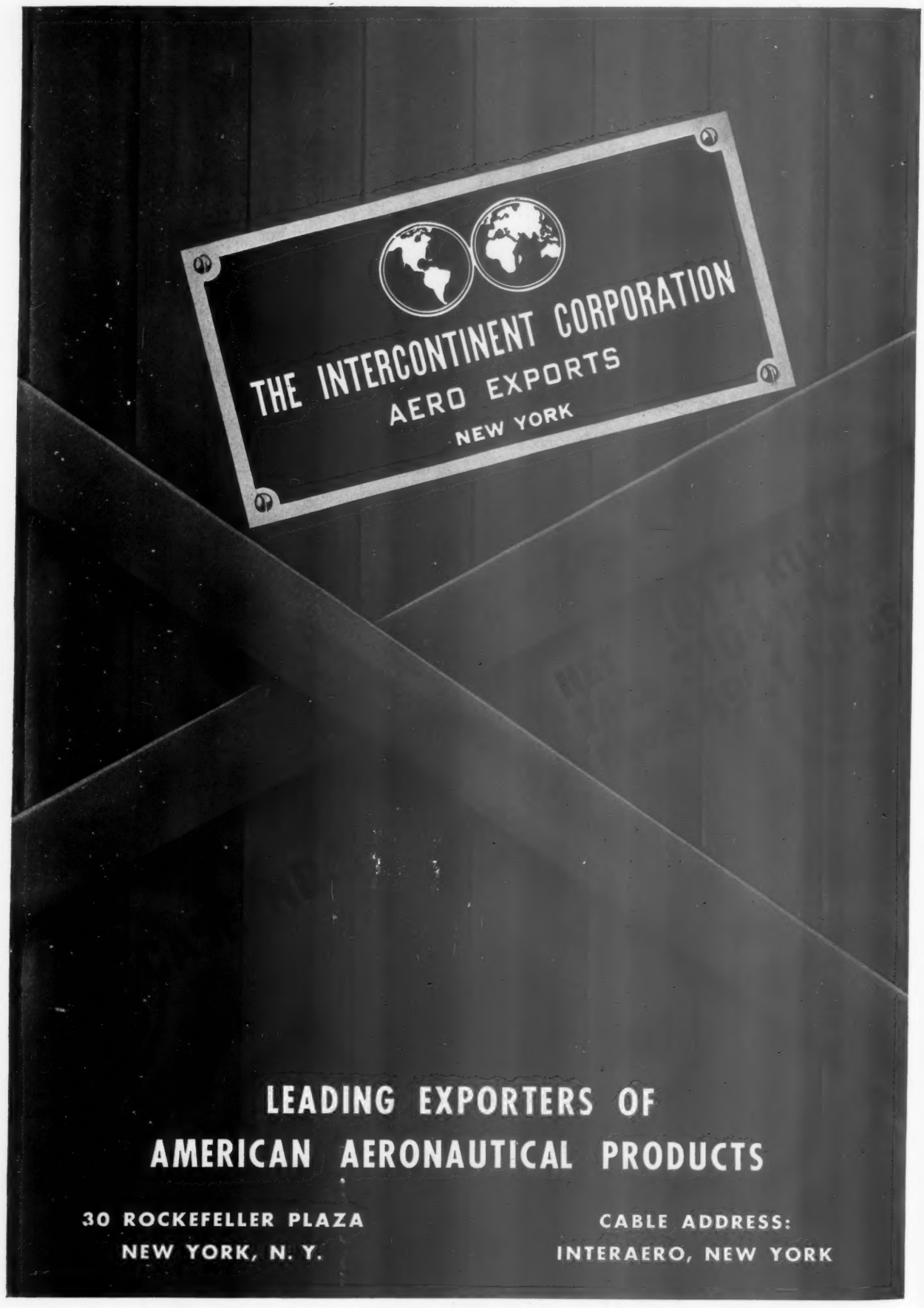
The light plane industry has been doing a fine job in the mass training of pilots. We must consider this and re-examine the possible applications of this type of equipment before we decide how this branch of the industry most effectively can be used. No nation has fully exhausted the military possibilities of all types of aircraft.

We must be thankful as a nation for our removal from close proximity to the present conflict. We must be grateful for this, the second warning of the fragility of all frontiers. And we must not fail to heed it. But we can't afford a stampede.

First we must decide on the geographical location of our frontiers. Then Congress must provide the necessary funds and modify the procurement laws to suit the occasion. Then the industry must confer quickly with Army and Navy officials and make a plan based on the attainment of a specific productive capacity in a specific period of time. Consideration must be given to export and domestic military needs, as well as the requirements of non-military operators. Subcontractors must be mobilized to protect the industry proper from over-expansion. In similar fashion the training of both pilots and mechanics and the establishment of bases and housing facilities must be reexamined in the light of the new requirements. Then, and only then, will we be ready to go forward forcefully and mobilize our vast resources for effective and lasting security.

» FLY AND GROW FAT should be the new slogan of the airlines. If you are a gourmand you can plan your trip so that you can have breakfast, lunch, snack, dinner, evening lunch, and some other nameless bites, all in a twelve-hour trip. It is a nice custom and we enjoy it.

We learned about this making a "circle tour," with our objective the Third Annual Southwestern Conference at Tulsa, via TWA, Braniff, American, Mid-Continent, and United (We spread our patronage). Luck


THE INTERCONTINENT CORPORATION
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AMERICAN AERONAUTICAL PRODUCTS
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INTERAERO, NEW YORK

was with us and we picked up a ride from Tulsa to Kansas City in Mid-Continent's first Lodestar. With its Hornets, the ship is fast, gets off in a hurry, and appears to be excellent for operation out of small airports. Interior is pleasing and comfortable.

A good sized investment in new equipment is being made at the two airline maintenance bases at K. C. Mid-Continent is tooling up for the new Lodestars and Dick Benjamin is busy inventing new gadgets to make their servicing easier and more economical. Over at TWA, Bill Maxfield, who took over when Walt Hamilton went to Douglas, is getting ready for the first Stratoliners which should be there when this is printed. The big hangar will shrink a lot when the new Boeings start coming in for service. It looked much smaller with DC-3s than it did in the days of the DC-2s. TWA plans to clip about 3½ hours off of transcontinental schedules with its new equipment. Only stop will be Kansas City.

At Wichita we visited Walter Beech and saw some of the twin-engined equipment he is building for the Air Corps. The excellence of finish of these sheet metal jobs compares with the fine finish of the fabric covered Beechcraft. Here the war was brought home to us when we saw a Canadian Beechcraft fitted with "blackout curtains" in the cabin. They are controllable by the pilot and cover all windows on each side simultaneously.

Over at Cessna, Prentiss Cleaves took us around and showed us how they build the T-50. Prentiss is an oldtimer and he remembers what happened in 1929. Cessna will undoubtedly benefit from his good memory.

There's always more capacity in the old plant if you look hard enough for it. This is the sound philosophy of Stearman's Earl Schaefer, who also remembers 1929. Accordingly you find galleries around his plant for welding and other operations that need not be spread all over the main floor. There is a military cleanness and ease of production flow throughout this plant that is nothing short of amazing. Most of the available space in fabrication and sub-assembly is used but there is no sign of cluttering. Final assembly is so clean and easy that it is hard to believe that trainers are flowing off the line at a rate about as high as that of the largest light plane manufacturers. And at present only two of the three final assembly lines are in use. Light plane production men should visit the Stearman plant and observe how it is done there.

Spartan is stepping out with some new production talent and we saw some fine metal work and excellent interior finishing in the latest Executive on our trip through the plant with Warren Holladay and Chief Engineer Weining. Under the wise generalship of Tulsa's genial and hard-hitting Bill Skelly, both plant and school have improved. Captain Maxwell Balfour (whose article appears on page 64) has imparted true military standards to the institution and your immediate impression is comparable to that experienced at an Air Corps training center.

» FLYING WEST in Jack Frye's "Sun Pacer" the other day we were listening to the radio. Just as the villain was about to pull the trigger something pulled the plug and the radio stopped. We never found out whether or not the murder was committed. Exasperated we reached into the seat pocket for one of those "Dear Jack" suggestion folders and wrote a withering denunciation of the radio plugs. A short while later the plug for the seat ahead fell into our lap and with it the opportunity to perform a service for the attractive brunette who sat there. In fact, it was *the* opportunity we had hoped for during the entire flight. After we had succeeded in obtaining her phone number we tore up the "Dear Jack" letter, reached in the other pocket for a fresh blank and wrote Dear Jack "For Heaven's sake please don't ever put any radio plugs that really stick in your airplanes."

IT PAYS TO FLY

Maguire is planning to build 50,000 airplanes

Prepared . . .

TO LIGHT AS WELL AS TO FIGHT!

A well known single-engine attack plane

With BENDIX LANDING GEAR

Fairing neatly into the fuselage, Bendix retractible landing gear units combine air and hydraulic cushioning in proper proportion, while Bendix Brakes provide responsive and efficient ground maneuverability.

AN easy set-down, as well as a properly cushioned take-off and taxi-ing run are assuredly quite as essential in a combat aircraft as in any other service.

Bendix Pneudraulic Shock Struts, Wheels and Brakes are favorite military airplane equipment. Just as speed, maneuverability and reliability safeguard the personnel in flight, so do these Bendix Landing Gear units safeguard men and machines during those critical moments of ground contact.

Successful landing gear design is a matter of close co-operation. Such matters as the plane's weight, disposition of that weight, landing and take-off speeds and internal structure of the fuselage, naturally have a vital bearing on proper landing gear design, dimension, location and attachment. The earlier Bendix men are called, the more useful their skill and knowledge can be.

BENDIX PRODUCTS DIVISION

OF BENDIX AVIATION CORPORATION · SOUTH BEND, INDIANA

AIRPLANE WHEELS · BRAKES · PILOT SEATS · PNEUDRAULIC SHOCK STRUTS

Side Slips

By
ROBERT OSBORN

» MAYBE we're just old-fashioned or something, but we obtained far greater satisfaction out of the year-long safety record of the airlines than we did out of the proven effectiveness of aircraft in blitzkrieg and anti-blitzkrieg.

However, paradoxically enough, we need much bigger "anti-blitzkrieg" air forces in the Army and Navy of this country to insure that our airlines can continue to make safety records in peace.

» REMEMBER WAY BACK in the dear old days when pursuit ships used to be equipped with one or two .30 cal. machine guns, and even then were referred to as "flying forts"? We see by the papers recently that any self-respecting pursuit or fighter carries a couple of cannon in addition to four or more machine guns.

Any day now we're expecting that military aircraft designers will be

asked to turn out airplanes of this type adding a French "75" and carrying anti-"anti-aircraft" guns also.

» THE PROBLEM of the President's proposal to place the Civil Aeronautics Authority under the Department of Commerce, and to eliminate the Air Safety Board, will probably be settled one way or another before this appears in print. He is quoted as saying that two reasons for the proposal are that it would abolish some top C.A.A. salaries and would reduce the number of agencies reporting directly to him. Considering these reasons we can't see why the change isn't carried to a logical conclusion. At one time there wasn't any governmental control of aviation at all. Of course a lot of people were killed,—but there were no salaries paid out in either the Department of Commerce or the Civil Aeronautics Authority, and nobody reported to the President—only to the local Coroner.

» "TWENTY-ONE POUNDS OF BOSTON BAKED BEANS AND BOSTON SCROD were shipped last week by American Airlines from Boston to Los Angeles at the request of Montague Love, actor, who wanted an authentic New England menu for a party he was giving. The cost of shipping the food by air express was $20.16, in addition to $6.50 for telephoning the order."—Item from *N. Y. Herald Tribune.*

We know that a letter of complaint will be inevitable from our lone Boston reader but we must say that so far as we are concerned this represents an all-time low in airplane transportation. As the feller says we can take our baked beans and scrod or leave them lay, and we always leave them lay.

» A NEW YORK DISTRICT ATTORNEY claims that a Brooklyn "Murder Mob" sent their professional killers around to the different cities, where their services were desired, in airplanes.

My! My! It's downright discouraging that people should be using such a potentially peaceful invention as the airplane as a means of killing other people!

» AL CAPONE, late of Alcatraz prison, was reported to have always used a standard statement whenever the police came around to ask questions concerning certain homicidal difficul-

ties between the Capone gang and other gangs,—which was "We don't want no trouble."

There's lots to be considered in that statement, and we suggest that it be used as a slogan for our national preparedness for national defense.

» ALSO, it's not an inappropriate motto for the engineering and service departments of any airplane or engine manufacturing company.

» WE'VE JUST THOUGHT OF A WONDERFUL IDEA for a picture to be used in the advertising for an airline. With the ship standing at the loading ramp have a handsome pilot looking out of the pilot's cabin window and exchanging salutes with a beautiful stewardess standing in the foreground just in front of the wing of the plane.

There will be no charge to any airline wishing to use this picture in its advertising,—as all of them have been using it continuously since airlines were started. First thing you know the flying public is going to get the impression that all flying personnel of our airlines spend their spare time going around saluting each other.

AVIATION FOR JUNE 1940

AT THE FAIR...

the public will get an airport-fence view of all that is new in the aeronautical world.

EVERYTHING pertaining to aeronautics has taken on a much deeper significance than it had a year ago. Focal point this summer for the nation's greatly intensified interest in aviation will be the Aviation Building at the New York World's Fair. Even the insatiable curiosity of the most aviation-minded visitors will be satisfied with this year's show.

Many new features have been added to the aviation display. Most striking exhibit is a moving panorama of beautiful aviation pictures in color which sweep across a gigantic screen. Photographs of all phases of private, commercial and military aviation are combined in a unique parade.

A number of new military airplanes loaned by the Army and Navy are exhibited to show the public what is new in fighting ships. These include a Douglas bomber, a Curtiss-Wright P-40, a Bell Airacuda, a Navy Grumman, an SBC scout bomber, and a Vought-Sikorsky.

Several private planes in various price classes are on the floor and available for easy inspection. The cut-away mockup of the large Curtiss-Wright Transport, which was one of the big attractions last summer, will again draw the crowds.

The airlines have combined to put on an even better show than they had before. With air travel booming to new highs each month, the lines are taking the public behind the scenes to show the organization that makes it all possible. Visitors at the Fair are being acquainted with airplane inspections, overhaul of engines and accessories, and the operation of many parts of a great transport. Meteorologists are at work plotting their weather data and forecasting conditions. Dispatching airways traffic control, radio operation and other air-

(*Turn to page 114*)

Soaring on the WEST COAST

California gliding reached new heights in popularity at the April Contest at Arvin.

By Charles F. McReynolds
West Coast Editor, AVIATION

SOARING is booming to new highs in this country if we may judge from results of the recent Third Annual Western Championship Soaring Contest held at Arvin, Cal., April 13–21. In spite of very weak soaring weather, notable performances were established and the meet was comparable with Elmira's national championship contests of a year or so ago. With 47 pilots flying in 26 different sailplanes there was constant activity throughout the nine days of the meet. A total of 427 flights were made, with credited cross-country mileage of 1,172 miles, and a total flying time of 363 hours and 54 minutes.

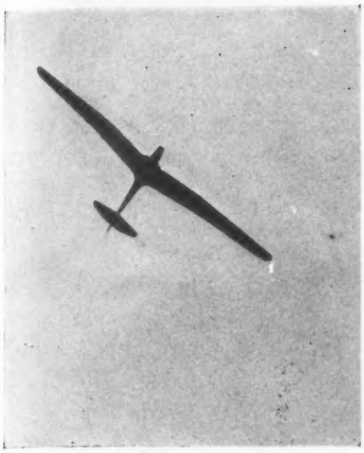
Greatest distance flown was 170 miles, which was made by two pilots, Woody Brown in the Bowlus Super Albatross, and John Robinson, flying the Ross-Stephens "Zanonia" gull-wing sailplane. These San Diego pilots also finished one-two in the point standing, with Woody Brown again winning the championship.

Woody Brown, twice winner of Arvin soaring meet, left, with John K. Northrop, noted designer, posed in front of Brown's Bowlus Super Albatross glider.

L to r, Major Ray Cooper, manager of Southern California's Soaring Assn.; Don Stevens, who holds world's glider loop record; Wm. Hawley Bowlus. ***Aviation photo.***

L to r, Wm. G. Brieglеb, John Ludowitz, and Dr. W. B. Klemperer with the Brieglеb taper-wing sailplane. ***Avation photo.***

Right: a parachute lowers tow rope after glider releases, preventing whipping and tangling of rope.



John Robinson, winner of second place, flying the Ross-Stephens sailplane. *Aviation photo.*

Sven Ingels in the cockpit of the Hall two-place "Cherokee", while Stan Hall adjusts cockpit cover and Jay Buxton attaches the tow line. *Aviation photo.*

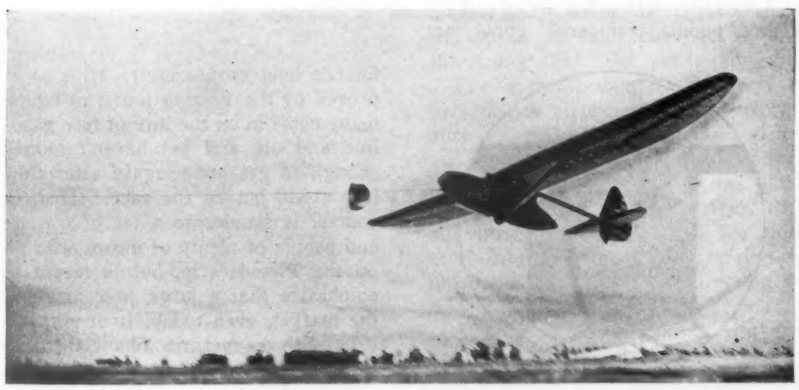
A real feature of this year's meet was the large number of pilots who put up really good performances. Three pilots added legs to their Silver C requirements, either for height, duration, or distance, and eight pilots won the coveted "C" certificate as soaring pilots by staying above the point of release for a minimum of five minutes. Some 25 Pacific Coast soaring pilots have now qualified for the "C" rating without which it is not possible to compete at Elmira. Although Woody Brown took first both for duration and distance, the maximum altitude was established by Wm. G. Briegleb, who finished down in eighth place for all-around points. Another example of the closeness of the contest was that Henry Stiglmeier, who came within four minutes of matching Woody Brown's total duration, and who actually exceeded Brown's duration point score because of extra credit for his longest flight, was down in fourth place in the final standings. While the winner had a total of 2,108 points, there were eight pilots who had more than 1,000 points.

So far did this year's performances outclass those of previous Arvin meets that the future for Western soaring looks very bright indeed. The weather was almost cloudless for the full period of the meet, yet numerous flights were made on ridge and thermal currents to distances of 25 to 50 miles. And on the one storm front of the meet both Brown and Robinson made a notable team flight of 170 miles across the desolate Mojave desert to 29 Palms, small desert community more than 100 miles east of Los Angeles.

Goal prizes were won for flights to various resort hotels in the vicinity, including Lebec, Gorman, and Grapevine, while numerous goal flights, or goal and return flights were made without special prize incentive. Three flights were made to Grapevine and return, a distance of 30 miles each way, and five pilots flew out over the flat valley to Arvin and return, a distance of 10 miles each way. Interesting and significant is the chart of cross-country flights, which showed that they reached to almost every point of the compass. It is not too much to expect that next year distance flights will be limited only by darkness, as indeed were the duration flights this year.

A classic example of the sort of soaring done at Arvin this year, was the exploit of Henry Stiglmeier, who came drifting down to a landing about 9:30 at night on the last day of the meet, after almost everyone else had packed up and gone home. His crew had supposed that Stiglmeier was down somewhere on a cross-country flight so there were no lights on the field and he landed in almost total darkness. He had been soaring all day high on the slopes of Bear Mountain and had stayed up there among the crags and pines even after sunset, although all duration time was automatically counted to sunset only. This same Bear Mountain furnished much of the spice of the meet for, unlike the Elmira terrain, the geography in the Arvin area is extremely rugged. Bear Mountain rises to an altitude of about 7,000 ft., about 5,000 ft. above the Arvin take-off site. Its slopes are heavily wooded and marked in places by great granite cliffs extending vertically for hundreds of feet. And it was on and above this mountain that five or six pilots at a time would soar throughout the meet, communing with the crags and rubbing wings with the hawks and eagles.

(*Turn to page 102*)



Take-off of the new Bowlus tandem two-place training sailplane.

Now that a mass market is here engineers will produce a faster, more efficient light plane

"This is what I mean—"

TOMORROW'S LIGHT PLANE

will have these features, says

William B. Stout

President, Stout Engineering Laboratories

Cartoons by the Author

THE private owner is fast becoming a center of attention as the next great phase of aviation. When airplanes have been built which will make 30 miles per gallon and 80 miles per hour and can be flown with very little skill so far as operation is concerned, then, from the standpoint of the general public, the private-owner plane will have arrived.

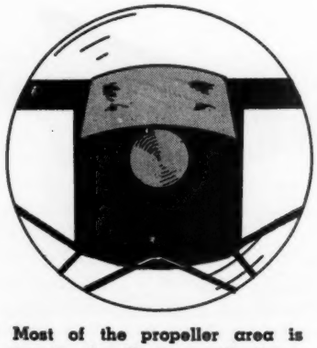
The problem of the light plane is not a simple one. Ninety per cent of the private-owner planes today are selling on a price basis. While the public thinks of airplanes as something of unlimited scope of travel, and while they can be used for long hops as the Florida Cavalcade has proven, most light plane owners still use their ships primarily for flights around their home airports.

To even design a high-speed cross-country plane for this type of market today is questionable. That is, it is questionable if the market is there for that speed and range in view of the lack of experience of most of these pilots. The private-owner plane has come, so far, through the thrill of enjoying flight and flying of one's own vehicle.

This coming generation is not going to be satisfied to live in *two dimensions* as have all previous generations but demands the third as part of his daily experience. He is just about as well satisfied with a 50-m.p.h. plane as he would be with a 100, and perhaps more so for this first stage—since flying cost per hour is so much cheaper for this college type, to whom a dollar this way or that means a great difference.

A vast majority of the owners of the little "puddle jumpers" could not finance long cross-country trips as is proved by the Florida tours, to which many come in on the lure of free gasoline and oil, and yet haven't money enough to get home again after they lose a $10 bet on the race. This, of course, is slander to a lot of owners and people of plenty of means who go on the Florida trip, but is meant to emphasize that a large percentage of the market, even today, is of *enthusiasts* with as yet no financial background, who are bound to fly anyway and whose very participation in flying on that basis indicates an initiative and driving ability that is bound to put them on top later. I emphasize this point, however, to show that in the private owner field, today, *cost is the first fundamental.* Even *safety* has been compromised with in these designs, from the standpoint of vision, in order to obtain low cost.

It is not so difficult to design a new airplane, to make it fly, and to get an ATC, as compared to the real difficulty of finding a quantity market where that plane can sell in quantities large enough to enable the manu-



Most of the propeller area is interfered with in small planes

facturer to do a good job within the price range.

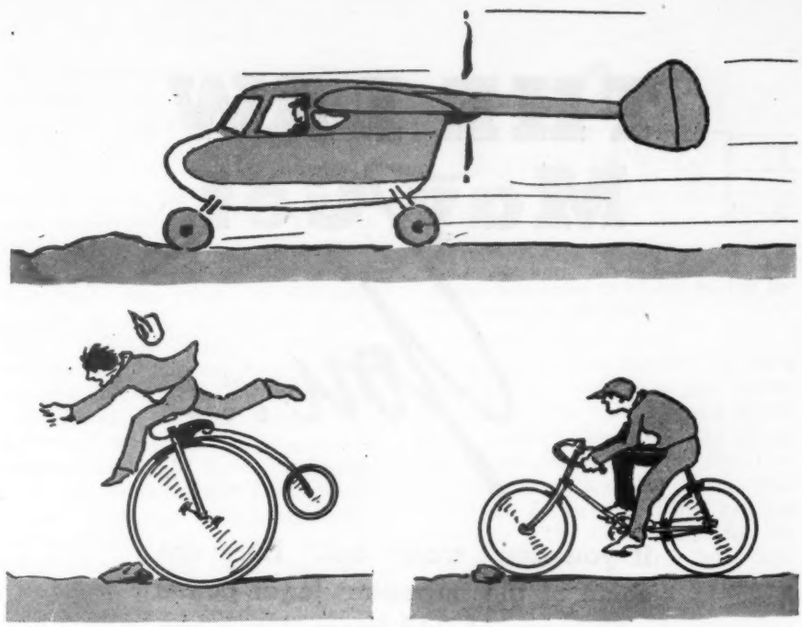
The little four-cylinder ships have hit a market and a large one. It is expected that 6,000 planes will be sold next year and at least 10,000 the year following, and that is a lot of airplanes.

It took the automobile industry twenty years before all designs looked alike, when at once the industry developed into a price war instead of an engineering war.

Low and behold, however, the "puddle jumper" industry starts out by everyone copying the original design, so that except for a little more wing here and a little less tail there, and a slightly different shape of cowling, all of these little ships *look* about the same.

The fact is, the cost of engineering a new design to meet the field is too high for a shoe-string organization to tackle; and this business, like all other businesses, must start on a shoe-string and grow a natural growth. Let's give every credit to the pioneers, who have done a remarkable job to date. It is too early, however, to concentrate completely on production and forget that the plane must grow better or the industry will wind up where the tri-motor business wound up—with lots of production tools and no market.

Already the number of ships sold has proved that the market for a ship under $3,000 exists and the further below, the greater the market. However, present owners of these planes are already casting their eyes around for something better and yet they must have the same economy, approximately the same first cost, and greater performance. Present-day small planes may be looked at as the Model T design of the airplane field:—cheap, practical, and safe enough for present-day requirements.



Safety landing gears are more necessary on airplanes than on bicycles.

We are fast approaching a time, however, when a Model A must come out, with twice the traveling performance of the Model T. With present engine sizes it is perfectly feasible to step up our cruising speeds to 110 m.p.h. or more, yet with better landing facilities than today.

We would not think of buying a transport plane with outboard struts, exposed landing gear, wooden propeller, and a fuselage behind the propeller two-thirds the diameter of that propeller.

One of the greatest mechanical detriments of the present type is a small propeller blowing against a big fuselage.

These small planes, in flight, blow so much wind against their own chest that it is a wonder they don't catch cold—and every bit of that drag is parasite. The smaller the plane, the bigger is the fuselage in proportion to the propeller, as men are all the same size. Therefore, in a small ship it is going to be necessary either to arrange a pusher propeller with its full propeller disk active in pushing, or else to go to twin propellers out on the wings.

Tuck in the small plane landing gear and cantilever the wings to do away with the struts, and 15 m.p.h. extra speed would be available immediately. The percentage of gain of horsepower would be much higher than in the big ships, hence *it is more necessary to clean up these small planes than the big ones.*

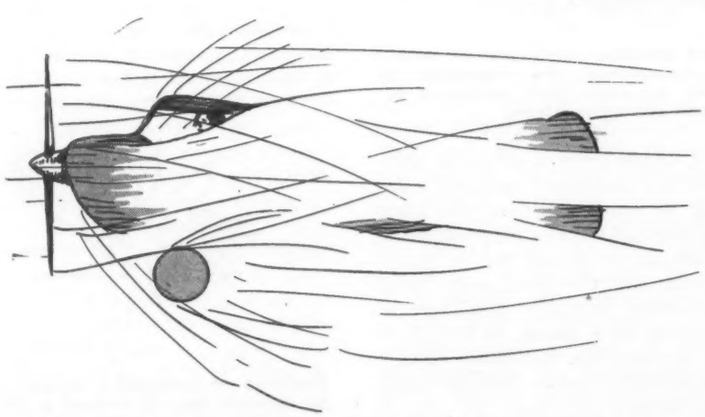
So far as engines are concerned, our present size and weight of engine, with what we have learned in the last two years, can just as well be a 90 hp. job which again helps the owner, and while he is increasing the speed of his plane he is also increasing the miles per gallon.

The greatest danger, however, to present-day airplanes is not performance or cost, but automobile vision on an air vehicle. The motor car driver needs to see only *in one plane* and the present *airplane* driver, who sits under a wing with a big nose cowl in front of him, has vision in only one plane—in the direction in which he is going.

A ship might be under him and he could not see it.

It might be over him and he would

(*Turn to page 102*)



The vortices of the propeller slipstream ruin whatever streamlining a tractor plane may have.

THE LAW May Get You...

if you don't watch out. Here are some of the important legal points which you should know if you run an airport or a fixed-base operation.

By Solomon Rothfeld
Member of the New York Bar

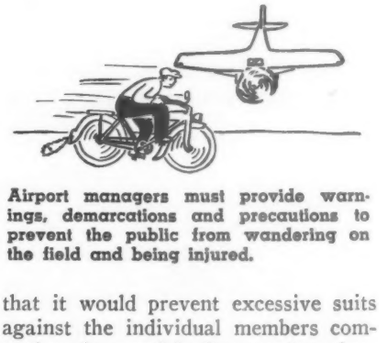
TO the average layman the life of an airport manager is an envied one. Like the venerable keeper of the lighthouse he is pictured as the eternal philosopher grappling with the moral ethics of life, watching his daily crop of ships come in and depart. But, unfortunately "The Law" refuses to share this picture. In fact, as a result of many different obligations placed upon him, the airport manager is being constantly weighed down with new and burdensome obligations.

It is the purpose of this article to enumerate some of the obligations of an airport proprietor to the public in general, to specially invited guests, to tenants renting space, to those renting an entire hangar, to employees, to trespassers and others either legally upon the premises or otherwise. Damages sustained off the airport will not be considered here.

In dealing with airports some courts have at times made a distinction between municipally owned airports and airports owned by private individuals or private corporate owners. This distinction is based on numerous grounds, a few of which will be enumerated here.

The American System of Law was originally derived from Old English Common Law. In order to protect the sovereignty of the King of England, the English Common Law formulated a hard and set maxim that the King can do no wrong, therefore, he could never be sued. Applying this same maxim, some courts have held that a state or municipality cannot be sued when engaged in a governmental function, and that the operation of an airport was a governmental function. (189 S. E. 63).

Other reasons for this governmental immunity have been given. Thus some courts have relieved a municipality of liability on the ground



Airport managers must provide warnings, demarcations and precautions to prevent the public from wandering on the field and being injured.

that it would prevent excessive suits against the individual members composing the municipality, or that since the municipality gains no profit from the function it should not be liable, or that to hold the municipality liable would retard municipal employees in performing their duties, or that it is better to have the individual who is damaged suffer than to have the entire public suffer.

In fact in four states, statutes were passed specifically providing that a municipal airport is exempt from liability. Iowa, North Dakota, Texas and Wisconsin have such statutes.

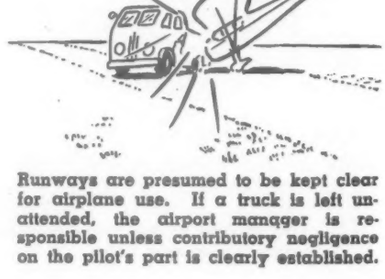
In the case of *Mayor of Savannah vs. Lyons* (Georgia) 1936, the court held that the plaintiff, who, while riding a motorcycle over a pavement at the airport, sustained severe injuries as a result of a break in the pavement, which the airport should have known was a source of danger, could not recover from the municipality because the city was engaged in a governmental function and therefore was immune from liability. In this case the court also relied on the statute originally creating the airport which specifically provided that the airport was for a *governmental purpose*.

But a majority of state courts have held that a municipality operating an airport is engaged in a private enterprise and not a governmental function and for that reason is liable in damages for any injuries sustained by a third party as a result of the municipality's fault, just as any other private airport proprietor would have to be.

Thus in the case of *Read vs. New York City Airport Inc.* (New York

If an airplane swerves into a crowd, the airport manager may have to shoulder the blame. The courts contend he should have foreseen the danger and have prevented it.

1932) 259 N.Y.S. 241, the plaintiff, an airplane pilot, sued for damage to his airplane resulting while the pilot in landing struck a truck performing work on the airport. The court ruled

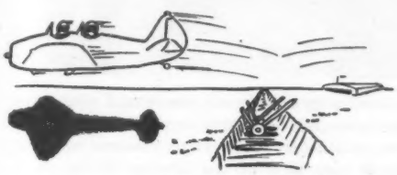


Runways are presumed to be kept clear for airplane use. If a truck is left unattended, the airport manager is responsible unless contributory negligence on the pilot's part is clearly established.

that the ordinary law applicable to private owners of airports applied to a municipality operating an airport but refused the plaintiff any recovery on the ground that the plaintiff was contributorily negligent.

In those states in which the courts have held municipalities liable for damages caused by their fault, the same obligations enumerated here are applicable equally to municipally owned airports.

The courts have imposed upon airport proprietors different degrees of



Airport proprietors must exercise ordinary, reasonable and prudent care to keep the premises in a safe condition for the use of pilots.

care depending upon who is involved.

I. *To the Public in General,* the airport proprietor or manager must exercise ordinary, reasonable and prudent care to keep the premises in a safe condition for the activities and operations known or anticipated by him.

This duty or obligation is a broad one and covers considerable ground. Thus if the airport proprietor or his employees have knowledge that a certain part of the field is used by the public, that part of the field must be made safe. If the airport proprietor knows, or if he should as a reasonable man anticipate, the use by the public of that part of the field, he must repair any defects to that part of the field that might cause any damage to the public. If he sees these defects, they must be immediately repaired by him. Even if he did not see the defect and it was such that if he exercised his duties in a reasonably careful manner he would have discovered it, the airport proprietor is liable.

This duty is therefore an active one. The airport owner must always be on his toes. He must watch where the public goes, what defects exist at that part of the field, and must take active means to correct the defects which not only exist to his own knowledge, but those defects of which he should have known if he prudently attended to his duties.

In *Mollencop vs. City of Salem* 8 P (2nd) 783 (1932), the defendant, a municipal airport owner, left a sagging and loose wire on the field. The plaintiff while using the field and carrying a child in her arms stepped over the sagging wire. At that moment some strange party either stepped on the wire or flipped it thereby raising the height of the wire and caused the plaintiff to trip and suffer severe injuries. The court ruled that the defendant city operating the airport was subject to the same liability as a private airport owner. That it was for the jury to determine whether the defendant in permitting a sagging wire on the field, exercised ordinary, reasonable and prudent care for a use of the field by the public it knew of or should have anticipated.

II. *To Specially Invited Guests,* the airport proprietor or manager must use reasonable and prudent care in keeping the facilities, lights, roads and approaches to the field, comfort rooms, restaurants, buildings, etc. in a safe condition for the activities and operations known or anticipated by him.

To this class belongs the general public invited to visit the airport for joy rides, for air circuses, for balloon ascensions and air races.

This duty though in many ways similar to the duty owed to the public in general is in some ways broader because at such gatherings as air circuses and air races there are large crowds of people and often many

It is assumed by law that passengers are entitled to safe equipment and that pilots are competent and able operators.

children. The airport proprietor must take such active precautions by erecting barriers and demarcations so that the people attending will not get hurt where one can reasonably foresee or anticipate any dangers. Furthermore, this class of people is usually unacquainted with airfields and therefore less aware of possible existing dangers. For that reason the duty of the airport proprietor is broader as to specially invited guests.

In *Brickbrad vs. James S. Salmon and Baltimore Air Terminals, Inc.,* 189 A. 265, a young boy rode his bicycle to an airfield at which an air circus was advertised. Upon reaching

If a person trespasses on forbidden parts of the airport and is injured he has no legal claim for damages.

the airport the boy started to cross a bounded road without anyone warning him to stop. The boy was struck by a landing plane and was killed. His administrator sued the pilot, the airport owner and the party who leased the entire airport and ran the air circus. The Court found that the pilot and owner were free from fault but ruled that the lessee who managed the airport was liable on the ground that he owed a duty of making the premises of the airport safe and that he should as a prudent man have foreseen the danger and provided warnings, demarcations and precautions.

In *Christopher vs. City of El Paso* 98 SW 2nd 394, the plaintiff, a child of thirteen years of age, was injured at an air circus as a result of a motorcycle driven through a burning fence, running into the plaintiff and causing severe injuries to the plaintiff. The plaintiff sued both the owner, the City of El Paso and the party who leased the entire airport and managed it. The court held that the city as a municipality was equally liable as a private proprietor but ruled that since the city leased the entire airport, at the time of the leasing it had no reason to reasonably foresee the danger created here and was held not liable. The court ruled that the lessee should reasonably have foreseen this danger to the plaintiff and should have warned the spectators by erecting rope fences and putting up warning signs; that the lessee was liable for failing to adequately warn spectators and in failing to use ordinary care to see that spectators were in safe positions.

In *Platt vs. Erie County Agricultural Society* 164 A. D. 99, 149 N. Y. S. 520-1914, plaintiff, six years old, was watching an airplane take off at a County Fair. The aviator while landing then swerved from his course, one edge of the right wing striking plaintiff who was standing outside of a "court" made for the airplane. The defendant claimed that sufficient space was left for the plane and further that policemen were

(Turn to page 108)

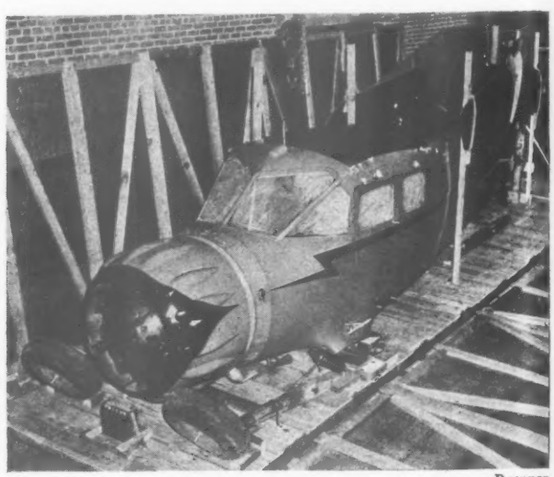
After outer wing panels, tail surfaces and propeller are removed, both interior and exterior of engine are sprayed with anti-corrosion grease. Propeller shaft is greased and taped. Skin covering is also greased.

Wing root is covered with waterproof paper and edges are bound with bakelite-backed adhesive tape. This procedure is carried on for all similar openings to prevent moisture from penetrating to any part of the interior of the ship.

BOXING FOR EXPORT

A new branch of the aviation business has developed in recent months due to the war

By Howard J. Emerson



Drennan

A Stinson being boxed for a private owner in England.

OUT of the war a new industry has developed—boxing airplanes for export. It is an industry that is seldom seen by the public, because it occupies that small gap between the factory door and rough sea voyages to many parts of the globe. This new industry is directed by aircraft engineers, assisted by a gang of skilled carpenters, metal workers and a fleet of heavy-duty trucks.

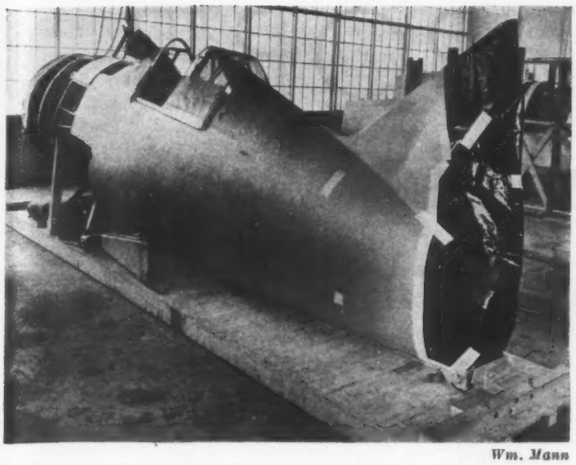
It is an important business, because expensive airplanes that are to be subjected to the rolling and heaving of a storm-tossed ship must be handled as carefully as a cargo of priceless china.

And it is a big business—in dollars, in tonnage, in military value. Export cases weigh more than the planes they carry, can cost nearly as much as a light airplane. But when millions of dollars worth of brand new aircraft must reach its destination in perfect condition, every step in the boxing process is worth the time and effort required to do a good job.

Last year 1,211 airplanes, valued at $66,386,736 were exported. The bulk of these airplanes were boxed before they were shipped, according to Robert Barr, of the Barr Shipping Corporation, whose firm handles about 80 per cent of aircraft exports. The cost of this export boxing cannot be figured accurately as no manufacturers or boxing company will release actual cost data, but it runs to a very sizable figure. With the huge backlogs of orders from foreign governments that are now on the books, export boxing for 1940 and 1941 should show a great increase.

But what is there that makes the product of this industry an "aircraft export case" instead of just another box? It seems to be that all-important element of "engineering." One boxing concern in the East, Dade Brothers, Inc., has gone so far as to register the phrase "Engineered Export Cases." From George Dade, general manager, I gathered the important elements that go into aircraft export boxing. He explains how it started:

"Not long ago there was little difference between boxing an airplane and boxing machinery, or a piano, except to make a larger box. But, in the last few years the great increase in unit cost of aircraft, and the advent of all-metal construction, the need for export case engineering and expert



Wm. Mann

A Brewster fastened to floor of export case with taping of openings partially completed. Tail has been securely taped. Special fastenings are engineered for each particular ship. Note sturdy construction of the flooring and braces.

Drennan

A Republic being boxed for Sweden. After plane is securely fastened to floor, ends and sides of boxes are bolted together but do not touch the ship. Wheels are wrapped and strapped to floor. Small box at rear contains carefully wrapped small parts.

Outer wing of a Republic being bolted to steel structural members which in turn will be bolted to side of wing case. Channels are drilled with special jig furnished by factory. Wings must be handled with great care during shipment.

Wm. Mann

Center wing section of a Brewster supported in center by a rigid framework. Wing-tip sections, ailerons, rudder, elevators and other small parts are greased and then wrapped in waterproof paper before being secured to framework.

Republic wing in a wing case, showing how structural channel members are bolted to case. Mechanic on left is using a nut runner to tighten bolts. At right, lowering top into position. Drennan photo.

workmanship became necessary. We come into the picture primarily as aircraft engineers, with the purpose of designing an export case that will protect the plane as well as cover it. We accomplish this by fastening the plane to the floor of the export case by means of special metal fittings at the wing and/or landing gear and at the tail—the same two or three points where the plane is designed to take

(*Turn to page 120*)

AIRPORT
Fire Fighting

Gas and snow extinguishers have many uses around modern airports where fires may cause great damage.

By C. L. GRIFFIN
Walter Kidde & Co.

TAKE a puddle of gasoline a couple of feet long. Add a spark. Whisk fire once over lightly with a pound or two of carbon dioxide gas. Fire and carbon dioxide vanish in six seconds.

Or take a man-sized pond of fuel, or a gushing leak or overflow. Add spark as before. Wheel up a hundred pounds of carbon dioxide and turn on a real snowstorm. Ten to thirty seconds is usually enough.

This same gas that puts the fizz in ginger ale is conceded by aviation people to be the fastest-known fire extinguishing agent for flammable liquid and electrical fires. It is used by airports in a variety of forms, ranging from a foot-high pistol-grip type that handles like a tommy-gun, to a 10-ton truck holding thousands of pounds. But regardless of form, the basic principle remains the same: an inert gas compressed in a steel cylinder.

For those who never studied the physics of fire, here's an explanation of how this cylinder-full of inert gas works. Sea-level atmosphere has an oxygen content of 21 per cent. Gasoline requires at least a 17 per cent oxygen content to burn. Therefore if you cut the content to 14 per cent or so, the gasoline stops burning. Which is exactly what happens when you discharge a blanket of carbon dioxide gas and snow over a blazing surface. Though it billows out of the discharge nozzle at 110 deg. F. below zero, the gas functions by smothering rather than chilling.

Three-dimensional Action

Because most fires burn in three dimensions, it naturally follows that an effective extinguishing agent must also be three-dimensional, or gaseous. Liquid agents, for example, are severely handicapped in fighting a running or pouring fire, or a fire burning amid obstructions such as presented by an airplane motor or electrical equipment. And because fires often break out in such inaccessible and obstructed spots, much destruction can be done unless one has a gaseous extinguishing agent—which can penetrate to every crevice of a motor or follow a blazing stream up a hose.

Other advantages of carbon dioxide for airport use are that it cannot splash and spread a liquid fire, it causes no mess or damage, and its speedy action helps reduce the panic hazard. Furthermore it is safe to use on fires in live electrical equipment, for it is impossible for the potential to ground through the body of the fire-fighter.

Placing Gas Extinguishers

While no set rules for proper sizes and location of carbon dioxide extinguishers can be laid down because of the difference in airport layouts, the practice of major airlines serves as a guide. For example, starting with the plane itself, TWA places one lightweight 4-lb. unit in each cabin and another in the pilot's compartment. Clamped on the loading stand is a 20-lb. cylinder. Another 20 pounder is carried on the gasoline dispensing truck. In the shops, one finds carbon dioxide units on the

To guard against electrical fires, a number of airlines put a 2-lb., pistol-grip gas extinguisher on the battery dolly used during the engine warm-up period.

Hangar fires that may spread from one ship to another are especially dangerous. Fire-killing equipment should be kept close at hand and ready for use.

In the busy control tower at LaGuardia Field are many radio sets and other electrical equipment. A 15-lb. carbon dioxide extinguisher is essential equipment.

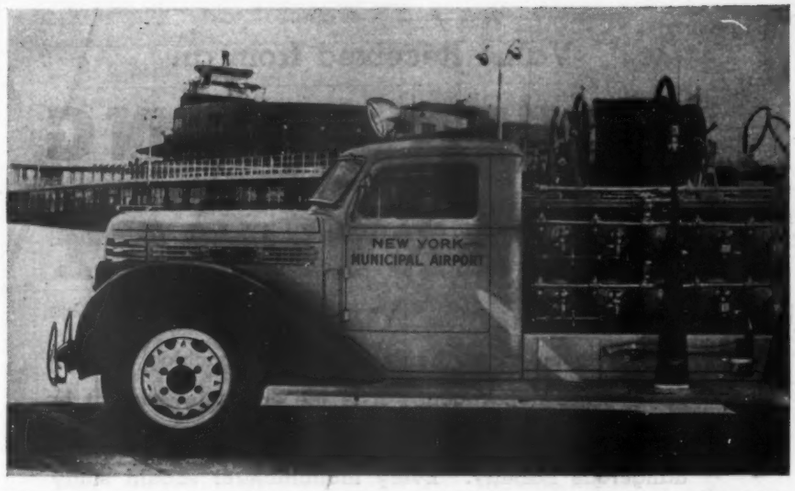
motor test stands, carburetor repair benches, welding department, and of course, wall-hung and larger wheeled units are spaced frequently around the aprons, hangars and shops.

American Airlines follows a similar plan. In addition to these points, a 2-lb. unit is carried on warm-up battery dollies, and a 15-lb. cylinder is affixed to the top of motor tune-up platforms. Many airlines place 50-lb. and 4-lb. carbon dioxide cylinders alongside each plane during warm-up periods.

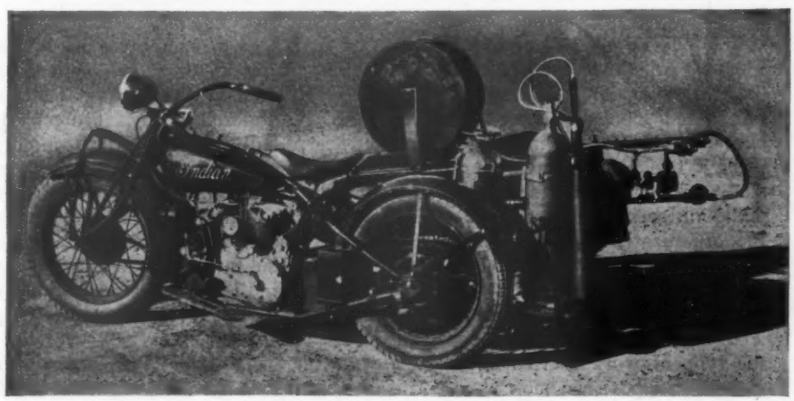
When cylinder capacities get up to the 50 to 100-lb. type, the extinguishers are equipped with wheels and handles for quick maneuverability. When still more capacity is indicated, airports can follow the lead of Floyd Bennett Field, which has several hundred pounds of the gas in cylinders mounted in a motorcycle sidecar and manifolded to a long hose. Such a set-up, one of the many motorcycle types scattered throughout the country, permits rushing a large amount of the gas to any part of a large airport, or even beyond it. Other types, such as trailers which are hooked to cars or pulled by hand, are also used here and abroad.

The ultimate in carbon dioxide extinguishers, of course, is the 10-ton, six-wheel truck such as the one developed for La Guardia Field and Navy airports by Walter Kidde & Company. This truck, which carries thousands of pounds of carbon dioxide, can smother the largest types of airport fires, and feeds the contents of stationary cylinders through

(*Turn to page 114*)

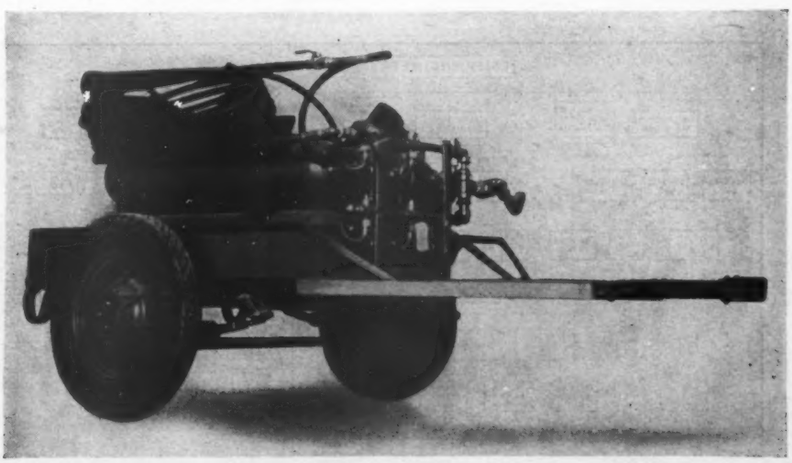


One of the fanciest fire trucks in the country is this 10-ton model designed and built by Walter Kidde for use at LaGuardia Field. It carries thousands of pounds in stationary cylinders and in portable equipment and hose on top will reach some distance from truck. Grappling hooks, axes, asbestos suits and gloves are part of the equipment.



Many medium sized airports cannot afford a special fire truck and use motor-cycles with a side car. Several types of extinguishers can be moved quickly about a field. The hose reel on top permits the operator to work at some distance from the motor cycle, which is of great advantage in fighting large fires on the field or in a hangar.

Every loading stand for TWA planes has a 20-lb. gas extinguisher which is ready for immediate use and yet placed where passengers do not see it.



A non-motorized unit such as this has proved to be of much value and the cost is not high. It can be hooked instantly to any car or truck. The six large cylinders it carries provide hundreds of pounds of carbon dioxide gas. The long hose and the discharge nozzle are valuable features. This two-wheel unit could be made in an airport shop.

Value Received from an

ENGINEERING DEPARTMENT

Far more important than your current backlog is your engineering department. It is the safest investment in your future. It may be your greatest asset or your most dangerous liability. Every manufacturer should study this exceptionally well worked out organization.

By Hall L. Hibbard,
Chief Engineer,
Lockheed Aircraft Corporation

"WHAT do all these men do? And how do you know that they are doing it?" That is the question asked sooner or later by nearly every visitor to an engineering department. The answer involves a close study of each of the several groups doing different kinds of work within the organization of between 800 and 900 men. The master chart (Fig. 1) shows how the department is organized, who is directly responsible to whom, and, in rather sketchy form, the type of work carried on in each group. Suppose we look at it for a moment, because it shows how group leaders are set up and how a small group of key men are able to keep tab on so many men doing so many different operations.

It is seen that the three men directly responsible to the chief engineer are J. E. Lewis, engineering manager; E. A. Peterman, chief project engineer, and C. L. Johnson, chief research engineer. Each of these men is a little king in his own province. Each is a motivating force in the development of a new airplane, yet their paths lead far apart and only converge again in their conferences with chief engineer and executives of the corporation.

The engineering manager is not responsible for the engineering of a new airplane. Rather, he is responsible for the men themselves. Operations of personnel, records of the men and of the work that the men do, are charged to him. It is up to him to keep the wheels going 'round. One of his chief lieutenants, W. R. Brown, is directly in charge of records of personnel, from which records, always kept right up to date, is determined whether a man is to be advanced in salary, given a position of greater or lesser responsibility, changed from one group to another, or advised to try some other type of work more suited to his particular talents.

Educational work calculated to help a new employee off on the right foot, or an older one to keep abreast of new ideas in the engineering world, is carried out by men under the engineering manager. Groups under him have charge of the filing of aeronautical records, books, trade publications and other data; contact with Civil Aeronautics Authority representatives; service; standardization of small component parts used in the industry as a whole; material; the estimate of how many working engineering hours will be required to engineer a new model, together with how many men will be required to work on each project for how many months, and how much the airplane will cost to engineer.

The chief research engineer is the Gallileo of the department. I do not know whether "Kelly" Johnson prefers a telescope or a crystal ball, but in either event he is living in the Land of Tomorrow. He and his men are constantly looking ahead. If they are not dreaming about or conceiving some new idea for tomorrow's airplane, they are testing out something already suggested, to see whether or not it will work and what adjustments

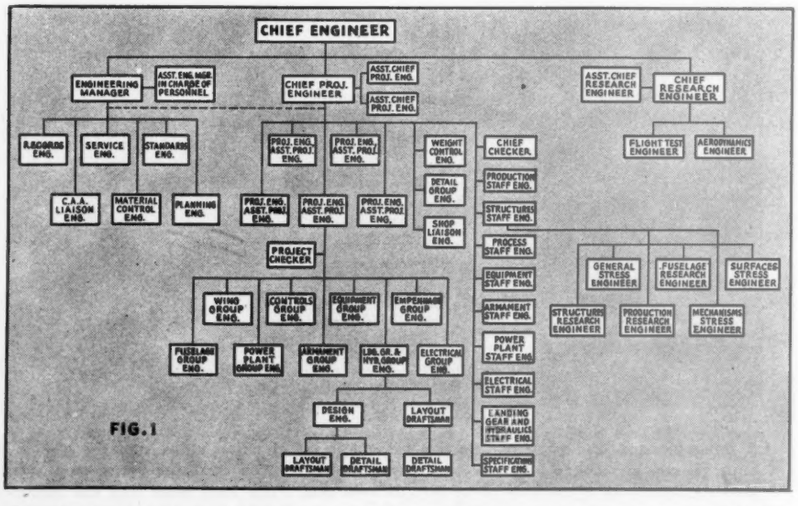


FIG. 1

Organization chart of engineering department, showing division of responsibilities.

or improvements are required to make it safer, faster or more economical to operate. They dwell in a world of aerodynamics, are ruled by the laws of physics, and have question marks on the brain.

Generally speaking, the chief project engineer's work begins where that of the chief research engineer ceases, or eases off. E. A. Peterman rarely goes to work on a project until it has been thoroughly scrutinized, tested and approved by "Kelly" Johnson. An idea may have been submitted to him, and some preliminary investigation carried on in his department, but before any large force of men is turned loose upon a project it must have been given the green light of practicability by Johnson and the chief engineer. Many an idea originating in project engineering goes to research engineering for approval there as something worth carrying out. Then, if it comes back approved as an airworthy idea, project engineering turns a battery of men to work on it.

A great majority of the engineers work under Peterman. He has more separate groups doing different kinds of work than either Lewis or Johnson. Among those who fall in the class of project engineers or staff engineers are a dozen or more closely allied assistants to Peterman. Under these men are the stress engineers, weight control engineers, electrical engineers; checkers; engineers assigned to wing, controls, fuselage, power plant, armament, landing gear, equipment, empennage, specifications and structures research. The detail draftsmen, layout draftsmen and design engineers are grouped under project engineering.

Special Occupational Rating

	EXCEPT'AL	ABOVE AV.	AVERAGE	BELOW AV.	POOR	
ABILITY TO DO ASSIGNED WORK	(Exceptional)	Good	Satisfactory	Lacking	Poor	
KNOWLEDGE OF WORK	(Complete)	Good	Adequate	Meager	Poor	
ACCURACY	(Superior)	Good	Satisfactory	Somewhat Inaccurate	Careless	
SPEED	Very Fast	(Rapid)	Average	Slow	Very Slow	
ATTITUDE TOWARD WORK	(Enthusiastic)	Very Interested	Satisfactory	Indifferent	Not Interested	
ABILITY TO LEARN	Quick	(Easy)	Average	Slow	Dense	
INITIATIVE	(Excellent)	Good	Sufficient	Lacking	Poor	
RELIABILITY	Highly Trustworthy	(Reliable)	Satisfactory	Irregular	Unreliable	
CONDUCT	(Excellent)	Very Good	Satisfactory	Doubtful	Troublesome	
RELATIONS WITH OTHER WORKERS	(Excellent)	Very Good	Satisfactory	Doubtful	Agitated	
WOULD YOU REHIRE? _Yes ☒ Doubtful ☐ No ☐					SUMMARY	

FIG.2

Rated and checked by Dept. Head J. E. Lewis.

Engineers are rated at regular intervals on ten qualities listed above

Whence They Come

These 850 engineers have come to us from all parts of the country. Contrary to the belief of many, a university degree is not essential, but when we consider for employment a man who did not graduate from college, we prefer that he has had experience elsewhere as an aeronautical engineer. As a matter of fact, a certain percentage of our entire engineering personnel are not college graduates—but those who aren't, because of practical experience, know their business quite as well as those who are.

We have more engineers from the University of Michigan than any other institution. At this writing, there are 49 men who attended engineering classes at the Guggenheim Foundation at Ann Arbor. Other colleges or universities well represented include California Tech with 31, Massachusetts Institute of Technology with 22, University of California at Berkeley with 22, University of California at Los Angeles with 17, University of Minnesota with 17, University of Washington with 16, Purdue, Illinois, and Colorado each with 13, Detroit with 12, and Stanford with 10.

There are 40 from the Curtiss-Wright Technical School, 29 from Parks Air College, 23 from the Frank Wiggins Trade School of Los Angeles,

(*Turn to page 122*)

A section of the Lockheed Engineering Department at Burbank, California.

FM

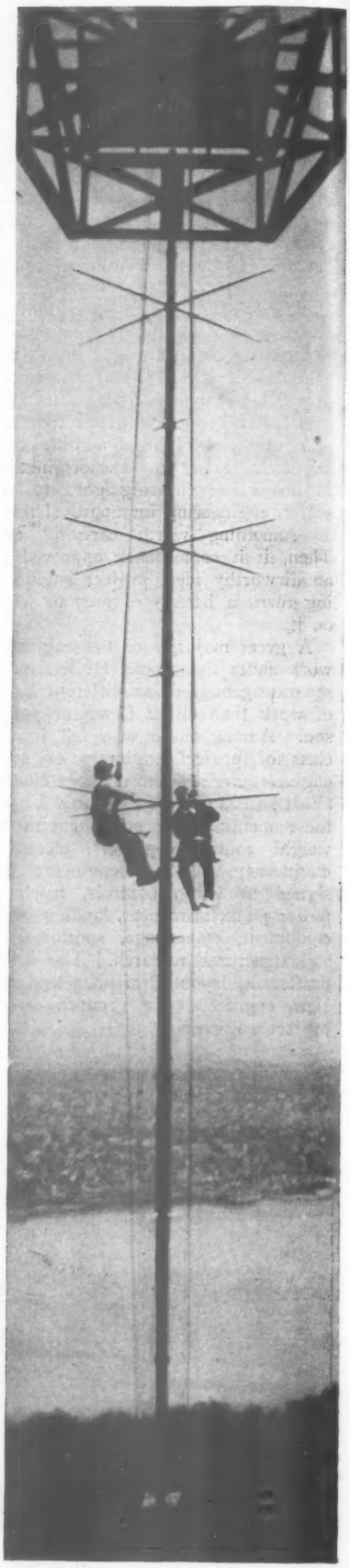
What it is and what it may mean in aviation radio.

By Don Fink
Radio Editor, "Aviation"

FREQUENCY MODULATION, or "staticless" radio, has come into its own in recent months, so much so in fact that radio broadcasting is getting set for a major revolution in its methods of doing business. One out of every seven broadcast stations in the United States has already stated its desire to erect a frequency modulation transmitter and to operate it simultaneously with its standard equipment. The Federal Communications Commission, faced with such a landslide of applications for licenses, recently held hearings over a period of two weeks in which engineering testimony was presented by as impressive a group of witnesses as ever assembled before that body. The concensus of opinion was that frequency modulation broadcasting can do a better job, so far as serving listeners within 100 miles of the cities is concerned, than any other known method of broadcasting, and that the system is sufficiently advanced to make advisable immediate commercial operation.

All this is of direct interest to workers in the radio business, but it has special significance to those who use, or depend on, aircraft radio, for two reasons. In the first place activity in frequency modulation (f-m) has given rise to a first-class contest for ether space in the ultra high-frequency spectrum, in which aviation radio has a very considerable stake. And in the second place, f-m in itself is a system which aircraft radio may use very profitably, not only to improve the quality and reliability of u-h-f service, but also to mitigate the interference problem. To cite just one example: two airport traffic control stations situated in airports very close together (say within 20 miles or less) may use the same frequency, and each may serve its own airport without interference to or from the other, if frequency modulation is used. This is true because when two f-m signals interfere, it is only necessary that the desired signal be twice as strong as the undesired one. If the ratio is two-to-one or greater, the stronger signal takes control and the weaker one cannot be heard. In conventional amplitude modulation the ratio would have to be 25-to-1 or higher. This selection principle, which is one of frequency modulation's greatest assets, is useful in every department of u-h-f aircraft radio where interference is a factor, not excluding marker stations and instrument landing. Moreover, the f-m signal is singularly free from other type of interferences, such as man-made static, ignition noise, etc., etc., which is so bothersome on the ultra highs. In fact, this observer is willing to go out on the limb and state that eventually all u-h-f aircraft radio services will employ frequency modulation. Compared with a conventional amplitude modulation, the

Don Fink and Major E. H. Armstrong



Right: Major Armstrong personally at work supervising work on the Alpine Antenna.

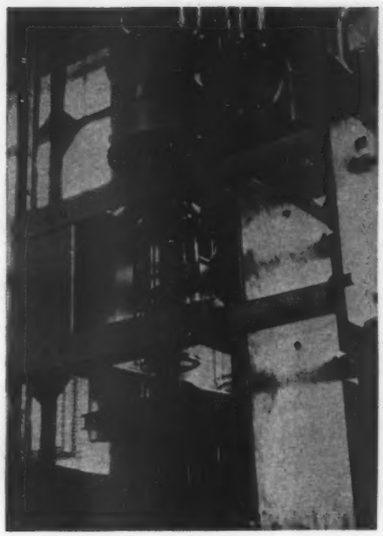
new system has no fundamental disadvantages (although there may be a few superficial considerations, as explained below), and it has four or five very definite points of superiority. All of which justifies the following report to the readers of AVIATION on the history and present status of frequency modulation:

The idea goes "way back"

Frequency modulation, as the name implies, involves changing the frequency or wavelength of the transmitting station. Whereas the conventional amplitude-modulated transmitter maintains a fixed position on the dial, the frequency-modulated transmitter moves back and forth over the dial, covering a narrow range. The amplitude-modulated transmitter gets its information across by variations in power output. The frequency-modulation transmitter, in contrast, maintains its power output constant, and gets its information across by wobbling over the ether spectrum.

In other words, the frequency modulation station has its frequency varied in direct proportion to the modulating signal. Suppose the modulating signal is a 1-volt, 400 c.p.s. note. Then the frequency of the transmitter output will swing over a range of frequency 1 kc. wide, say, swinging back and forth over the range 400 times per second. If the signal is increased to 2 volts, still at 400 c.p.s., the rate of swing stays the same, but the width of the frequency excursion increases from 1 kc. to 2 kc. If the frequency of the signal is increased to 1,000 c.p.s., and the voltage remains at 1 volt, the swing is 1 kc., but the swings occur 1,000 times per second. And so it goes. The width of the frequency swing is proportional to the strength (voltage) of the modulating signal, whereas the rate of the swing is proportional to the frequency of the modulating signal.

Such a simple idea as that must have a long history in the radio art. It has. In fact in the old days of the arc-transmitter, it was difficult to turn the arc on and off rapidly enough to form telegraphic dots and dashes, so it was common practice to detune the transmitter instead. The telegraph key connected additional inductance in the tuned circuit, thus shifting the transmitter frequency every time the key was pressed. The receiver was tuned to the "key-down" frequency and hence received the signal only when the key was pressed. Then came the vacuum tube, which was so easy to modulate by amplitude methods, that amplitude modulation



The 40-kilowatt final stage of the Alpine Transmitter.

was the obvious answer. And so it has appeared ever since, with a few minor doubts.

One of the doubting periods came in the very early days of broadcasting. Frank Conrad of Westinghouse and his associates, soon after they had put KDKA on the air in 1921, thought they might *conserve* ether space by using frequency modulation. When a station is amplitude modulated it uses a great deal of ether space, since the sideband frequencies occupy a width of frequency numerically equal to twice the highest modulating frequency. Thus present-day broadcast stations, designed for a maximum audio frequency of 5,000 c.p.s., occupy channels 10,000 c.p.s. (10 kc.) wide. The Westinghouse boys thought that if they used a transmitter with variable frequency they might be able to swing the frequency back and forth over a much narrower range, say 1 kc., and still get the program across. If this could be done there would be room for many more broadcasters. They were doomed to disappointment. When the frequency is swung sideband frequencies are generated just as in amplitude modulation (as was later proved by rigorous mathematics), and the width of the f-m sideband region at least equals the width of the a-m (amplitude-modulated) sideband region. So the experiments were discontinued, as just another good idea gone wrong.

Then, in the late 1920's Major E. H. Armstrong attacked the problem, and since then he has not only developed a practical system of using frequency modulation, but equally important, he has put it across to an industry who knew all about it and knew there was nothing to it. Major Armstrong's previous inventions include three of the four basic radio circuits: regenerative, superheterodyne, and superregenerative (the tuned radio frequency circuit is the remaining one). He approached frequency modulation looking for a cure for natural static, and he found it, but ironically only by using frequencies where natural static is not much of a problem. But in so doing he found a cure for other forms of interference, man-made as well as natural, and he found also the means of making complete realism of reproduction much more economical than it is in the older amplitude-modulation system.

The first demonstrations of Armstrong's equipment were given privately in 1933, and followed with cooperative experiments on a larger scale in 1934. In 1935, the system was described publicly to the Institute of Radio Engineers. The engineers were impressed but somewhat confused as to the real merit of the invention. In all fairness to this early bad judgment, it must be admitted that the case was not completely clear. The early demonstrations were comparisons between a-m transmitters on the standard broadcast band (where static is very prominent) and the f-m transmitters on the u-h-f bands, where there is very little natural static in the first place. Moreover, it was argued, the high quality of the f-m transmitters could be duplicated by a-m transmitters on the same band. What was not appreciated was that the system discriminates against all noise and static, including man-made static which infests the u-h-f bands, that this decrease in noise greatly extends the useful range of the station, and that the high quality could not be duplicated on a-m as economically as on f-m. The gradual swing from this early skepticism to the present acceptance was accomplished largely through the efforts of Major Armstrong himself, who built a 40-kw. f-m transmitter with his own funds, and demonstrated it to all who would listen. Demonstrations in 1938 and 1939 soon convinced broadcasters that here was bandwagon to be climbed on, and the rush for licenses began.

Wherein lies FM's advantage?

The secret of Major Armstrong's successful approach to freuency modulation lay in the use of a very wide swing of frequency. In the early Westinghouse experiments, a very narrow swing had been used in the ill-fated attempt to reduce the side-

(*Turn to page 124*)

Front view showing the small frontal area

Three-quarters rear view

New Ranger NAVY ENGINE

Model SGV-77OB-7 has a take-off rating of 520 hp. available at sea level and 9,600 ft. with a weight per horse power

By Jay P. AuWerter
Assistant Editor, AVIATION

CONCENTRATING on the objective of a high-powered engine with both light weight and small frontal area the Ranger Engineering Corp. has completed development on a new twelve-cylinder in-line engine. The approval of this engine has made available for national defense an engine with two-thirds less frontal area than military engines of the same power. Being of the inverted "V", air-cooled design it has, in addition to the 520 hp. rating, a rating of 450 hp. at 12,000 ft.

Cylinders

Closely following the development of the engine has been the work on cylinder head cooling fins with the result that the new head has double the cooling area of the original head with essentially the same overall dimensions. The cylinder heads are of cast aluminum alloy in which have been machined the hemispherical combustion chamber. Into the heads are shrunk one aluminum bronze intake valve seat and one steel exhaust valve seat and the whole head is screwed and shrunk onto the barrel. The cylinder barrels are machined from chrome molybdenum steel forgings, with fins integral, and have a ½-in. lip that fits into the cylinder head above the thread line. The barrel's sealing is borne on the diameter of the head and is secured to the lower half of the crank case by eight hold-down studs.

The intake and exhaust valves, one each per cylinder, are of the tulip type forged from alloy steel. Exhaust valves, of mushroom design, are sodium filled, both in the head and stem. The inlet ports open outward from each cylinder bank and exhaust ports open downward in a "V" between cylinder banks.

Full trunk type pistons of forged aluminum alloy are used, ribbed for strength and cooling. Three compression rings and one oil ring are used between the piston pin and piston head, and one oil scraper ring at the bottom of the skirt. Piston pins are of heat-treated alloy steel, hardened and ground. The pins are full floating and are retained by snap rings in the pistons.

Valve Operation

The camshafts are heat-treated alloy steel forgings, carried in housings which bolt directly to the cylinder heads. Housings and covers are of magnesium alloy, and each camshaft is supported on eight bearings, one located at each end of the shaft and one adjacent to each of the six pairs of cams. Each camshaft is driven from a separate vertical drive shaft which takes its drive from the front end of the crankshaft. The valves are operated by rocker arms which are provided with crowned-roller cam followers and ball type adjusting screws. The end of the adjusting screw is cupped and fitted with a hardened steel ball, the latter having a flat face which is in contact with the end of the valve stem. From the hollow camshafts, pressure oil is fed directly to the camshaft bearings. Holes drilled in the camshafts between each pair of cams supply a spray of oil to rocker arms, cam followers and adjusting screws.

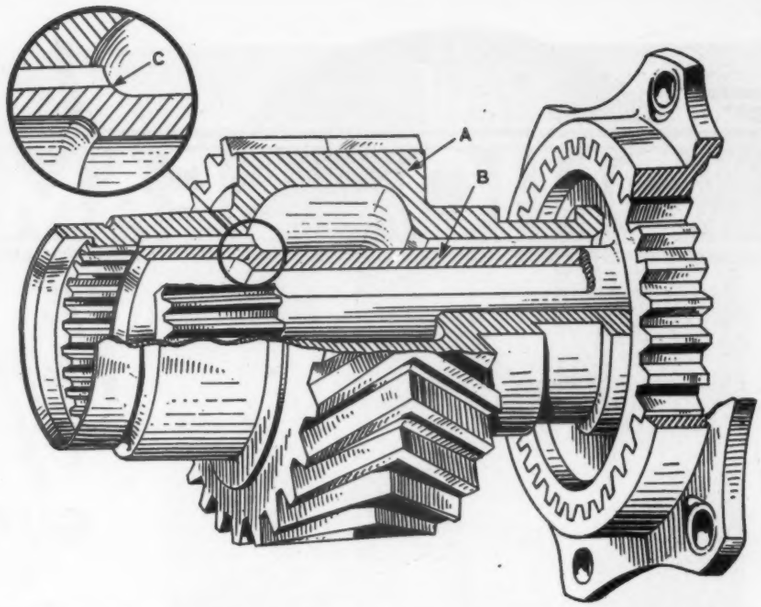
Crankcase

Cast light metal alloy is used for all crankcase sections. Upper and lower main sections are parted at the crankshaft center line. Both sections are ribbed for seven main bearings, and are clamped together by long studs anchored in lower webs and extending entirely through upper webs and crankcases, the parting flanges being held together by short studs. The accessory drive shaft is located in the lower section at the point of the V formed by cylinder banks. Four mounting feet are bolted to the crankcases, two located near the rear below the crankshaft center line, and two located near the front above the crankshaft center line.

The front section carries the reduction gears, the gears for driving the accessory drive shaft and camshaft vertical drive shafts, and the constant speed drive. The rear section carries the drives for all accessories and the supercharger, to which the carburetor is bolted.

Crankshaft and Dampers

The four dampers which serve also as counter weights for the six-throw, seven-bearing crankshaft represent a departure from conventional aircraft engine practice. They effectively reduce the amplitudes of all vibration periods within the operating range to nominal values.

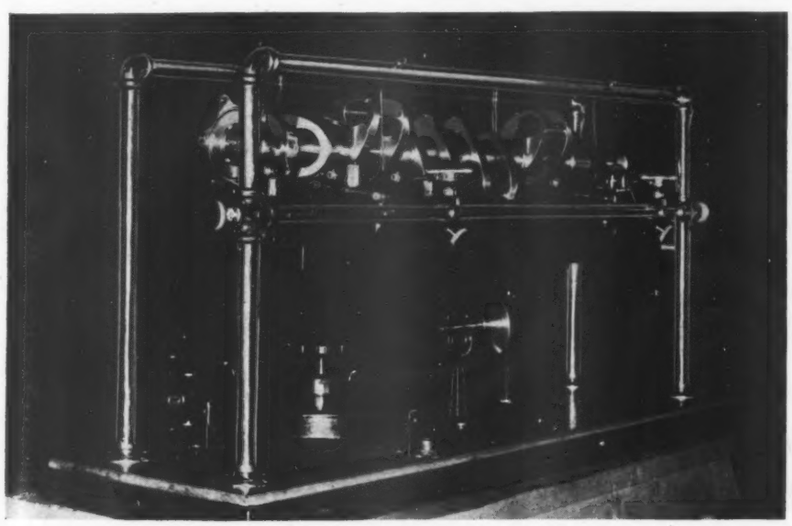


The spline teeth on the quill shaft "B" have been designed to minimize stress concentrations when the teeth are under high loads. As can be seen in the inset, the root of the tooth "C" has been raised above the other diameter of the quill shaft and thus distributes the stress into the shaft over a faired surface rather than an abrupt angle. If the roots of the teeth were on the same diameter as the shaft, high loads would shear them off at a lower stress. The flange at the right end is connected directly to the crankshaft. The power is then transmitted into the quill shaft "B", then into the herringbone gear "A" through the spline teeth. The herringbone gear, which for simplicity is not shown in detail, furnishes power to reduction gears.

New research equipment permits the quantitative and qualitative study of torsional vibration at all points along the crankshaft and propeller-shaft system, as well as permitting determination of both the optimum type and mass of damper required to suppress a given order of vibration and the influence of the selected damper design on all other orders and modes of torsional vibration.

Test results are optically projected to a darkened cross-hatched screen and show a linear representation of torsional vibration at test location.

The crankshaft is dynamically balanced both before and after the installation of the dampers. Main journals and crank pin are hollow and fitted with oil plugs. These plugs are designed to separate sludge and foreign material from the oil, and also act as oil transfers from the main journals to the crank pins. Crank pins are drilled for two-way feeding of oil from the main journal to crank pins. The rear end of the shaft carries the gear for the generator and starter drives while the front end is splined to a quill shaft through which the reduction pinion is driven.



The balancing machine for dynamically balancing crankshafts has been developed by one of the engineers of the Ranger Corporation. The crankshaft is placed on rollers on a floating carriage which is suspended by four equal length cords from the frame of the machine. The shaft is then rotated at a speed in resonance with that of the floating table and any unbalance causes the table to oscillate. Ames dials calibrated to 1/1000 inch measure the deflection of the table and the relation between the amount of inch ounces out of balance and this deflection determines the weight to be added or removed from the crankshaft. In the operation one end of the crankshaft is restrained while the other is free and can be balanced; then the system is reversed.

Reduction Gears

The reduction gears are of the herringbone type, only two gears being used. A short quill shaft provides the drive from the crankshaft, the front end of the quill shaft also being provided with splines for driving the

(*Turn to page 116*)

AT OHIO SEAMLESS

Vigilance born of Experience

GUARDS EVERY STEP FROM BILLET TO FINISHED TUBE . .

By long experience we know that no step is unimportant in the manufacture of high quality seamless steel tubing. That is why we give such painstaking attention to every detail.

Your interest in **OHIO SEAMLESS STEEL TUBING** quite naturally centers around the question of how it can serve you—meeting your most exacting specifications. That implies an interest in some of the basic reasons why, as well as how, **OHIO SEAMLESS** meets your requirements.

Avoiding technicalities and getting right down to brass tacks, we plan to present the story behind the making of **OHIO SEAMLESS STEEL TUBING** in a way that will answer those questions on both why and how. In the following months we will use this space to take you behind the scenes on a personally conducted tour. We believe you will find it both informative and interesting.

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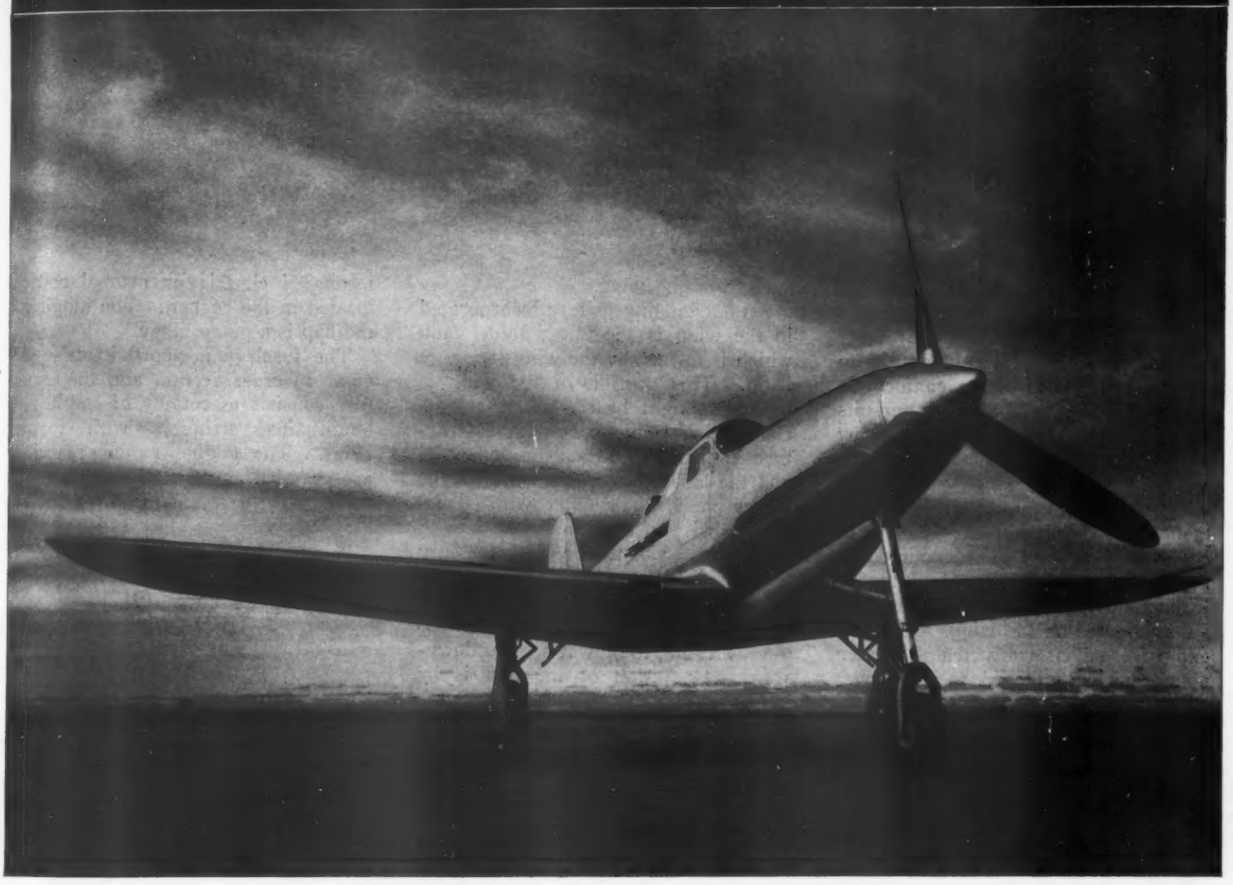
In the meantime we suggest that you consult our sales engineers on any steel tubing problem. They welcome the opportunity of being of service to you.

AIR BELL CRAFT

RECOGNITION OF MERIT...



Important recognition of the merits of the *Bell Airacobra* P-400 Interceptor Pursuit Airplane is found in its acceptance by the Anglo-French Purchasing Board. A quantity order has been placed to provide the Allies with the outstanding advantages of the *Airacobra's* striking power. As part of the United States air defense program, the *Bell Airacobra* P-39 is in production for the United States Army Air Corps.

Also manufacturers of the FM-1 twin engine Airacuda Multi-Seater Fighter for the U. S. Army Air Corps.

BELL
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BUFFALO, N. Y., U. S. A.
"WINGS FOR THE COBRA"

Republic EP-1 PURSUIT

With a cruising range of 750 miles at a speed of 290 miles an hour these ships may be destined to take an active part in the defense of Sweden

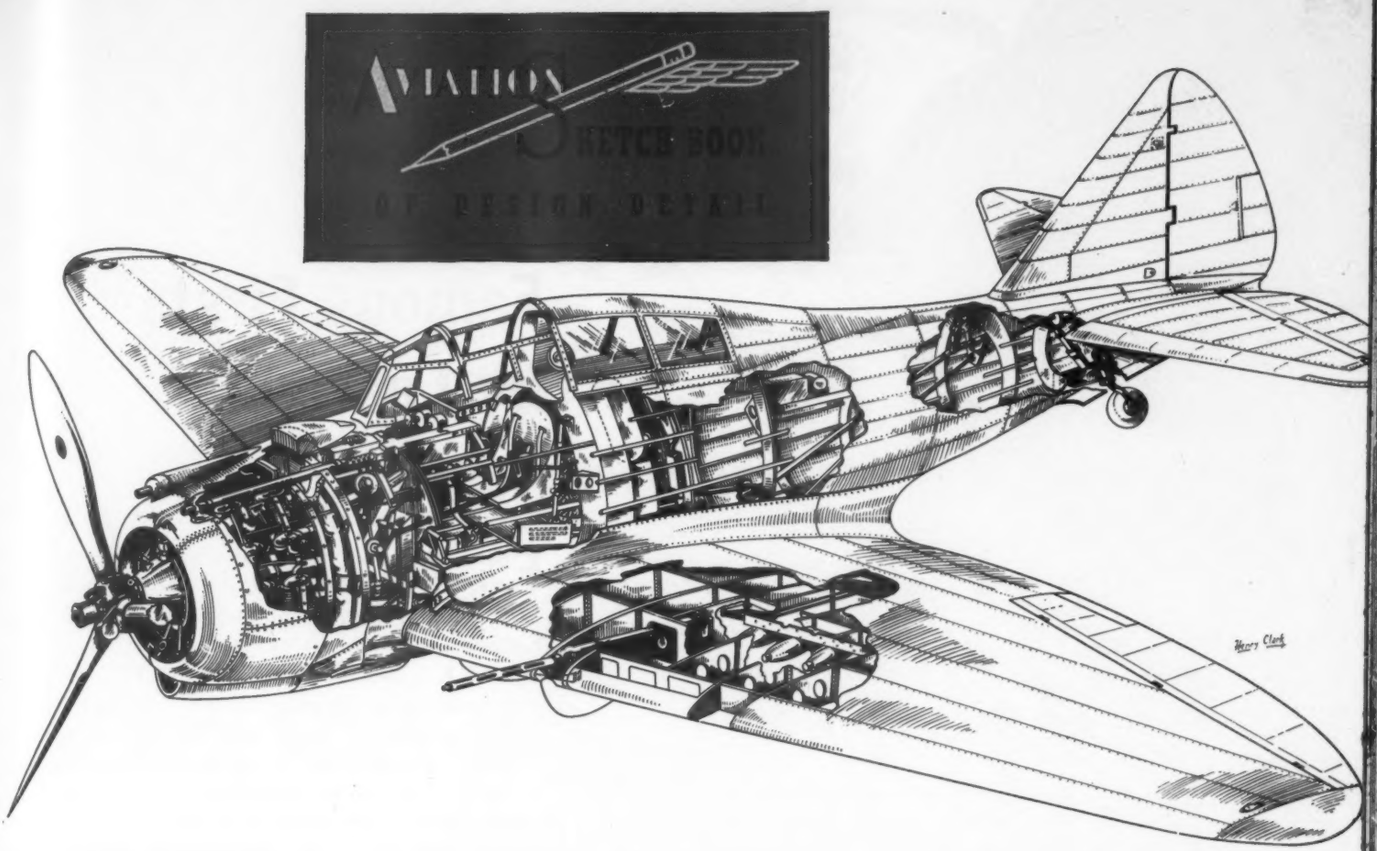
PRIOR to the German invasion of Norway the Republic Aviation Corporation delivered more than forty of their latest model EP-1 pursuits to Sweden. These airplanes conform in general design to the P-35 pursuits that have been prominent in the Army Air Corps.

The EP-1 is a single-place, low-wing monoplane with an all metal monocoque fuselage. Armament includes two machine guns, mounted on the fuselage and synchronized to fire through the propeller, two machine guns mounted on the wings and firing explosive bullets, plus ten seventeen pound bombs attached to the lower surface of the wing.

An outstanding feature incorporated in the wing is the integral fuel tank which is formed by the wing structure itself. This portion of the wing is made gas tight by the use of a special sealing compound and the structure in this area forms the end walls and the baffle plates, this being in the center panel. The outer wing structure consists of five main spars with fore and aft ribs to give the necessary torsional rigidity. The flap is formed by splitting the trailing edge of the wing into upper and lower sections and deflecting the lower section downward. Operation of the flap is by means of electric or manual control located in the cockpit. The hinge for the flap is a piano hinge.

The fuselage is approximately circular in cross section and the structure consists essentially of continuous longitudinal stringers with former rings. The engine mount reactions are carried into the structure by means of four main box section

Flying Equipment



longerons. Those carrying the upper mount attachment fittings extend from the firewall past the cockpit, and in this manner provide structural stiffness in the region of this opening. The two lower longerons extend aft only sufficiently far to distribute the reactions from the engine mount fittings into the fuselage structure.

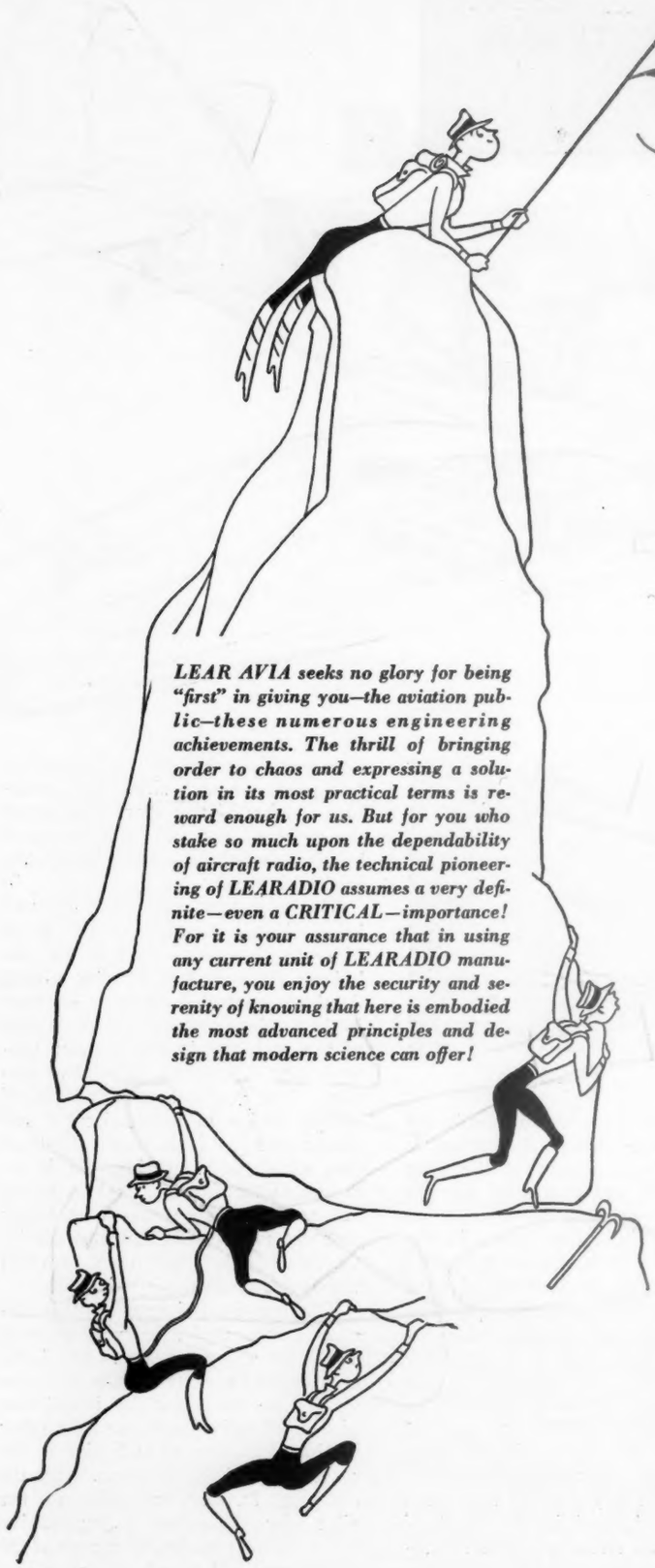
The cockpit is completely enclosed by a sliding canopy which may be locked in any one of several immediate positions. An emergency exit window in the canopy, and a dropable seat, allowing access to the baggage compartment with exit through the baggage door, are provided for use in the event of a nose-over.

The main landing gear is retractable, each leg consisting of a single oleo unit capable of taking side loads and bending. Fore and aft loads are taken by drag struts. Retraction is accomplished by means of the drag struts, which are connected by pin joints to the oleo unit and to trunnion blocks which slide on tracks in the wing. When in the retracted position, protection is provided in the event of an emergency landing with the wheels up, and landing loads distributed through pads into the wing structure. The tail wheel is of the steerable type inter-connected with the rudder and fully retractable in flight. The retraction is by the same mechanism as used to retract the landing gear, but is connected through a friction clutch, and in the event of the tail wheel sticking it will not affect the operation of the landing gear.

The stabilizer is a fixed cantilever type being attached to the fuselage at two points on each side. The structure consists of two spars meeting at the outboard end and inter-connected by ribs, the whole surface being covered with metal.

The elevators are made of two halves bolted together at the plane of symmetry, and hinged to the stabilizers through ball bearing pivots. A single control horn fully enclosed in the fuselage connects the two halves of the spar and in this manner prevents any differential or relative motion. The vertical stabilizer is of similar design to the horizontal stabilizer and is of all metal construction with metal covering. It is attached to the fuselage at two points and can be quickly removed for repair or replacement. The tail post carries the rudder hinges which are provided with ball bearings.

The question of armament is becoming more and more vital as each day of the war progresses. The EP-1 is designed to accommodate, and provisions are made for the installation of one .30 caliber and one .50 caliber machine gun, one on each side of the center line of the airplane, with the charging handles accessible to the pilot for charging. Ammunition boxes are to contain 200 rounds of .50 caliber and 500 rounds of .30 caliber ammunition for these guns.



LEAR AVIA seeks no glory for being "first" in giving you—the aviation public—these numerous engineering achievements. The thrill of bringing order to chaos and expressing a solution in its most practical terms is reward enough for us. But for you who stake so much upon the dependability of aircraft radio, the technical pioneering of LEARADIO assumes a very definite—even a CRITICAL—importance! For it is your assurance that in using any current unit of LEARADIO manufacture, you enjoy the security and serenity of knowing that here is embodied the most advanced principles and design that modern science can offer!

Famous Firsts by Learadio

FIRST radio receiver to serve the private pilot. *FIRST* popular-priced aircraft transmitter. *FIRST* commercial left-right direction finder. *FIRST* multi-frequency direction finder (covering 180-405 Kc., 500-1200 Kc., 1200-2800 Kc., serving also as a communication receiver on these frequencies, plus the band of 2800 to 6700 Kc.). *FIRST* self-locking hand-reel antenna. *FIRST* retractable fair-lead with warning light and switch. *FIRST* factory-tuned multi-frequency transmitter. *FIRST* low-cost aural-null direction finder for light airplanes. *FIRST* battery-operated portable range and broadcast receiver. *FIRST* AC-DC and battery operated range and broadcast receiver. *FIRST* dry battery operated itinerant transmitter. *FIRST* commercial automatic direction finder. *FIRST* fully automatic motor-reel (without relays). *FIRST* locally controlled receiver with separate IF power pack (eliminating remote control shafts). *FIRST* locally controlled transmitter with separate power-pack. *FIRST* locally controlled crystal stabilized receiver, transmitter, and direction finder (with plug-in crystal arrangements on panel). *FIRST* transmitter and receiver tuning dials with continuously adjustable dual-detent devices. *FIRST* commercial gyromatic navigational instruments. *FIRST* commercial automatic direction finder with quadrantal error corrector at loop antenna. *FIRST* automatic direction finder with (1) slide-rule frequency tuning scale, (2) shutter-type band switch and dial, (3) automatic noise suppressor, (4) multiple indicator units, (5) loop motor at chassis, (6) removable side type ATR chassis, (7) automatic high-low gain switch on loop, (8) Lear anti-hunt "Fastop motor and free wheeling clutch," (9) manually operated loop and automatically declutched motor (no over shooting due to motor inertia), (10) dynamic relay loop control system with Learadio proportionalizer circuit.

Lear Avia, Inc., Dayton, Ohio

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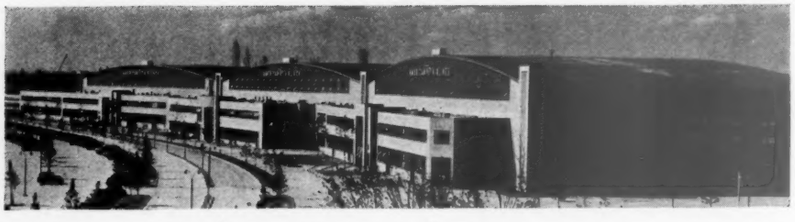
88%
of all transports ordered by U. S. airlines for 1940 delivery are Douglas DC-3s.
For 20 years Douglas' growth has continued apace independent of general world conditions. Fruit of this growth is the undisputed leadership of Douglas in the air transport field.
70%
of all airplanes in U. S. airline service are the DC series built by Douglas.
69%
of United States airlines fly airplanes built by Douglas.
IT PAYS TO FLY DOUGLAS

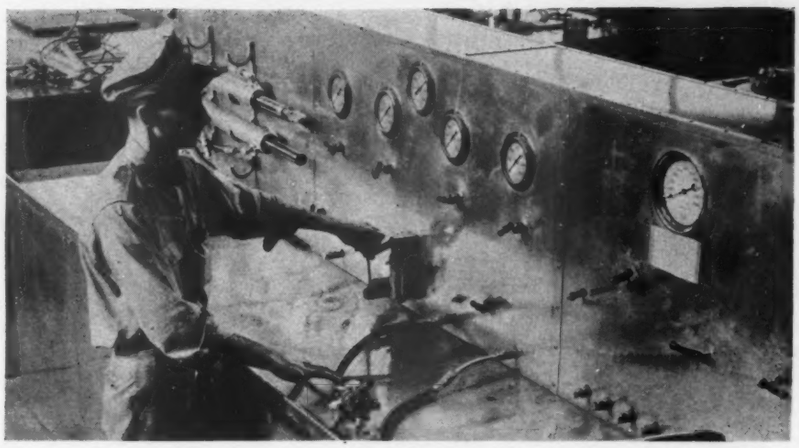
American Airlines
MAINTENANCE
at
LA GUARDIA FIELD

With a Parker tube bending machine one man can bend tubes accurately and fast.



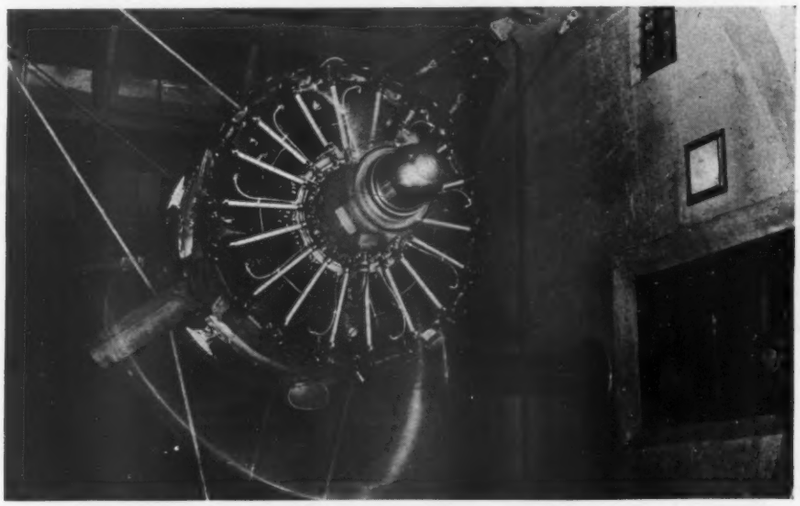
A section of one shop showing hydraulic test stands in lower left and fabric and upholstery department at upper left. Engines and propellers ready for use are stored beyond partition at left. Ship is being overhauled at upper right.

Mechanic operating new cylinder honer.



Mechanic is testing a hydraulic four-way selector valve on hydraulic test stand. This is a close-up view of test stand shown in shop view on the opposite page.

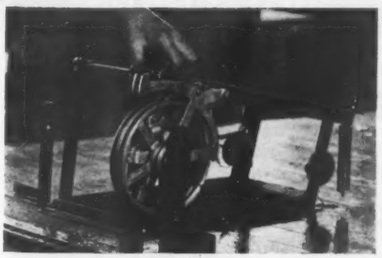
Testing a hydraulic pressure regulator on hydraulic test stand.



One of three engine test stands designed by American engineers for LaGuardia base where every engine is run in for several hours after it has been overhauled.

New machine made by Holley Carburetor for testing its non-icing equipment.

Much new test equipment is used. Mechanic is using electrical accessory test bench for testing deicer distributor valves and propeller de-icing pumps and motor.



Treadle-operated machine designed by A.A. engineers to test seat mechanism.

Steady Nerves FOR ANOTHER GIANT AIRLINER

HERE are control cables that are engineered and produced with the same precision as both power plant and structure of the newest aircraft. Only the finest steels go into their manufacture. Every wire of every cable is cold-drawn to high tensile strength through accurate dies, under the direction of men who specialize in the making of control cables that are as sound and trustworthy as modern science can make them.

That's why so many aircraft designers and builders specify American Tiger Brand Strand and Cords. That's why you'll find them used in America's finest ships.

***This engineer** is making final adjustments on cables controlling ailerons, elevators, wing flaps, and rudders. In this ship, as in other famous commercial, private, and service aircraft, all control cable is of American Tiger Brand Aircraft Strand and Cords.*

MEET GOVERNMENT SPECIFICATIONS

American Tiger Brand Aircraft Strand and Cords are available in either tinned, galvanized, or U·S·S Stainless Steel, in the following constructions:

19-wire Strand	semi-rigid
7 x 7 Cord	flexible
7 x 19 Cord	extra-flexible

These products offer superior strength, excellent fatigue resistance, and minimum stretch. They are fully in accord with the latest U. S. Army and Navy specifications.

AMERICAN *Tiger Brand* **AIRCRAFT STRAND AND CORDS**

AMERICAN STEEL & WIRE COMPANY

Cleveland, Chicago and New York

Columbia Steel Company, San Francisco, *Pacific Coast Distributors*

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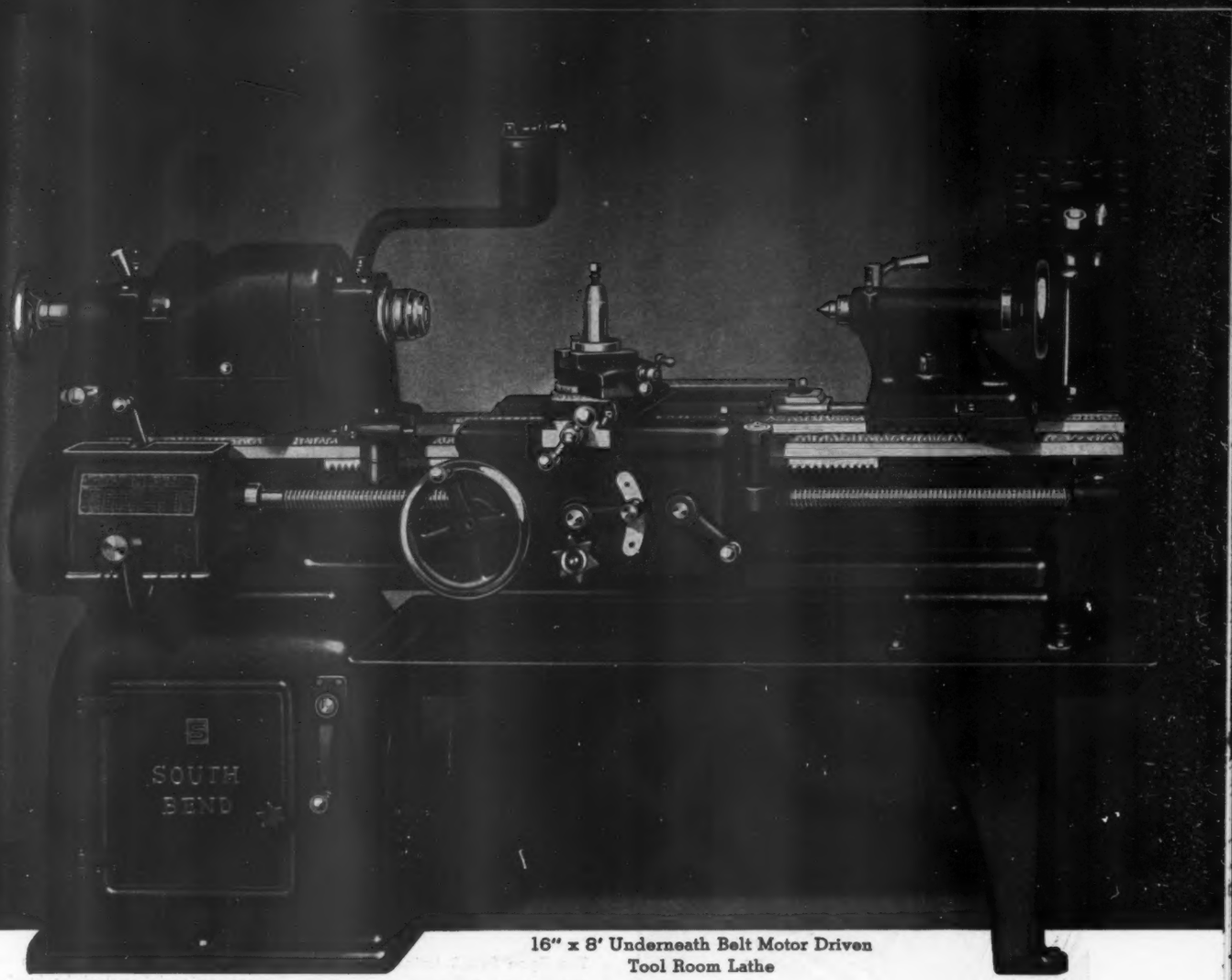
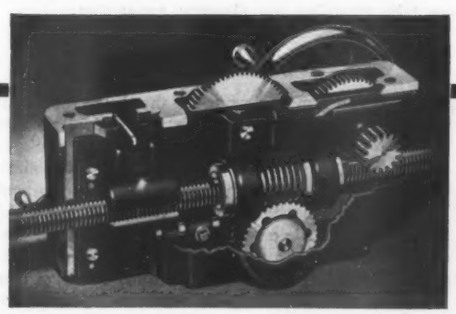
UNITED STATES STEEL



16" x 8' Underneath Belt Motor Driven
Tool Room Lathe

SOUTH BEND LATHES FOR PRECISION WORK



Double Wall Apron

Back view of the Double Wall Apron showing the rigid, one-piece box type construction that provides a substantial support for both ends of the gear shafts.

Gears in the apron are of steel and have a reservoir and felt wick automatic oiling system. Worm drive assures smooth operation of feeds on all classes of work.

A powerful multiple disc friction clutch operates both the Automatic Cross Feeds and Automatic Longitudinal Feeds. A slight turn of the clutch knob instantly engages or disengages the clutch.

South Bend Lathes have been giving thousands of users dependable service on the most exacting classes of precision machine work for more than thirty years. Sound design, the most expert workmanship and the best materials available are combined in South Bend Lathes to give them permanent accuracy and efficiency.

SIZES AND TYPES

Manufactured in 9", 10", 11", 13", 14½" and 16" swing, bed lengths 3' to 12', in Motor Drive and Countershaft Drive. Attachments are available for production, tool room and general machine work.

New South Bend Lathe Catalog

Write today for a copy of our new 112-page lathe catalog describing all Sizes and Types of South Bend Lathes, chucks, tools and attachments.

ON DISPLAY IN ALL PRINCIPAL CITIES

Popular sizes of South Bend Lathes are carried in stock for prompt delivery and demonstration by machinery dealers in 477 of the principal cities of the world. A few prominent distributors displaying South Bend Lathes are listed below. Write for name of the dealer nearest you.

Boston, Mass. — The MacKenzie Machinery Co.
Bridgeport, Conn. — A. C. Bisgood
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Detroit, Mich. — Lee Machinery Company
Houston, Tex. — Wessendorff, Nelms & Company
Los Angeles, Cal. — Eccles & Davies Mach. Co.
Milwaukee, Wis. — W. A. Voell Machinery Co.
Newark, N. J. — J. R. Edwards Machinery Co.
New York, N. Y. — A. C. Colby Machinery Co.
Philadelphia, Pa. — W. B. Rapp, Machinery
Pittsburgh, Pa. — Tranter Manufacturing Co.
Portland, Ore. — Portland Machinery Company
Providence, R. I. — Geo. T. Reynolds & Son
Rochester, New York — Ogden R. Adams
San Francisco, Cal. — Moore Machinery Co.
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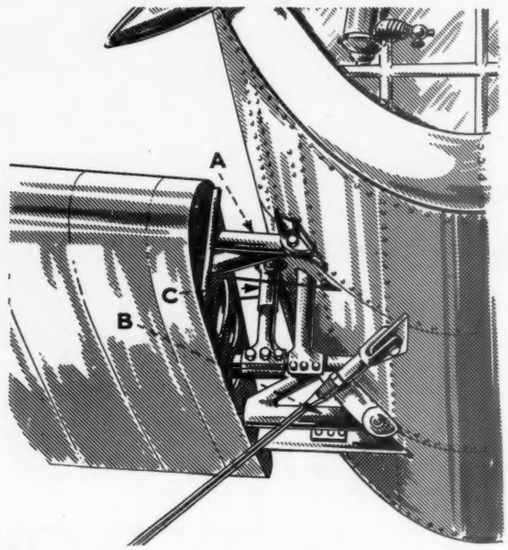
SOUTH BEND LATHE WORKS

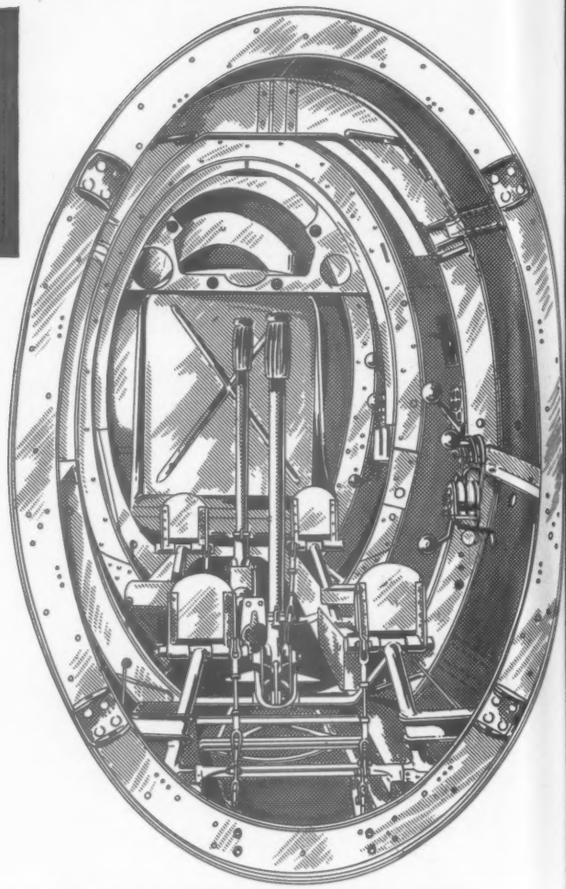
LATHE BUILDERS SINCE 1906

178 E. Madison St., South Bend, Ind., U.S.A.

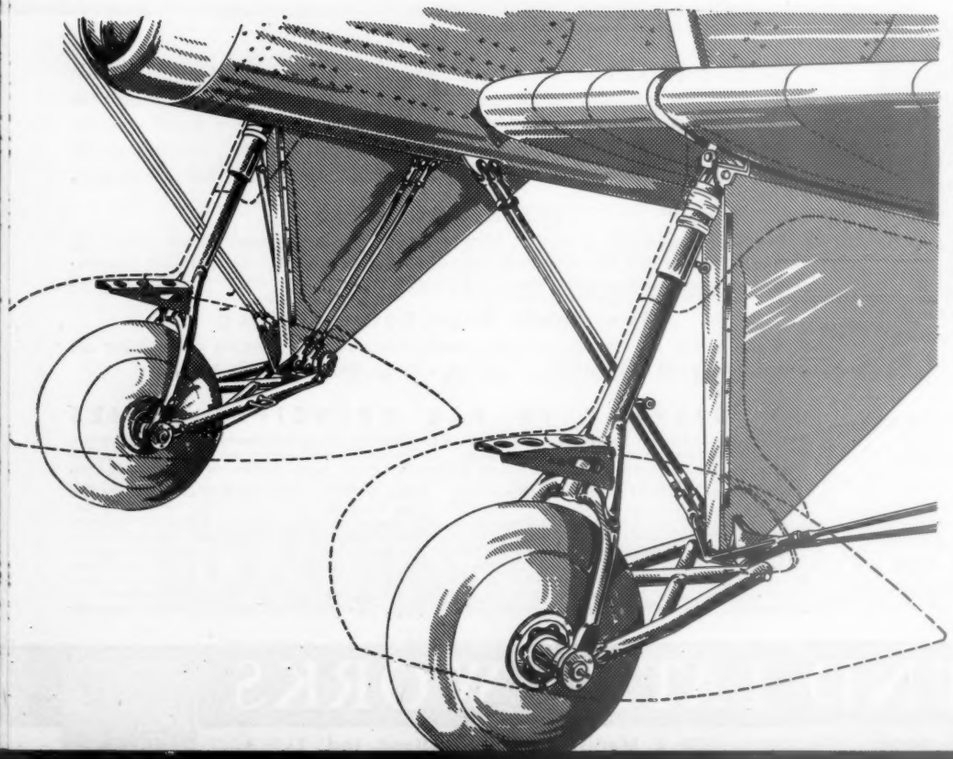
AVIATION SKETCH BOOK OF DESIGN DETAIL

The stub wings on either side of the Ryan STM-2 fuselage are of welded steel tube construction, with metal covering of the wing root. A and B are the members which join the built-up spars in the wing stubs to the fuselage. The flap control is through the leverage system at C coming from the cockpit and going to a torque tube that parallels the spars in the wing.

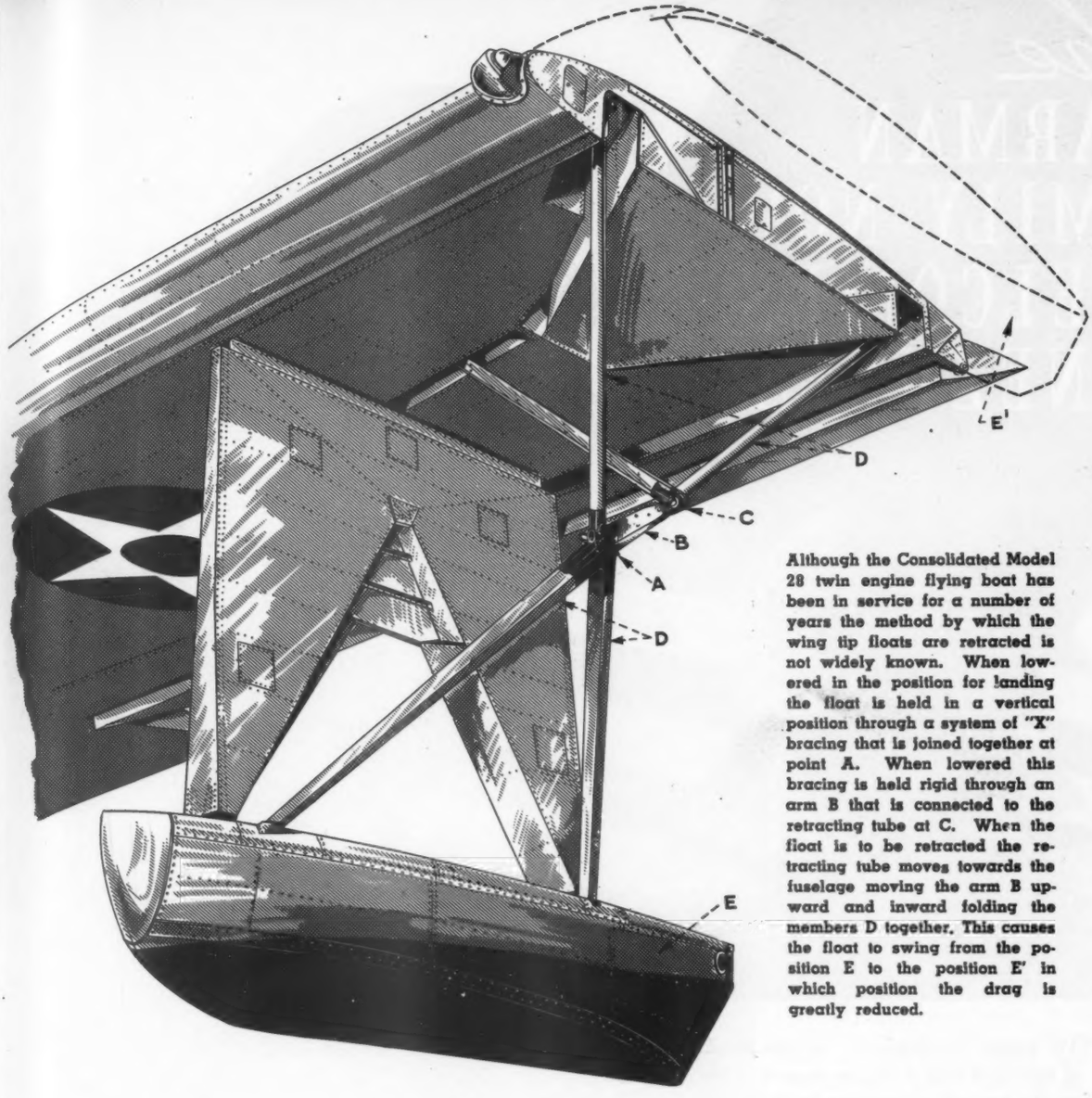




The Ryan STM-2 trainer has caused a great deal of interest in its construction as well as its performance. A cross section (above) of the fuselage reveals the semi-monocoque, stressed skin type of construction used. Elliptical in section one steel and seven aluminum alloy bulkheads are used. Six pieces of 24ST sections form the covering. Complete dual controls with dual toe brakes are installed. A torque tube mounted on aluminum alloy bearings connects the two sticks for aileron control and a push-pull tube inside the torque tube provides the elevator connection.

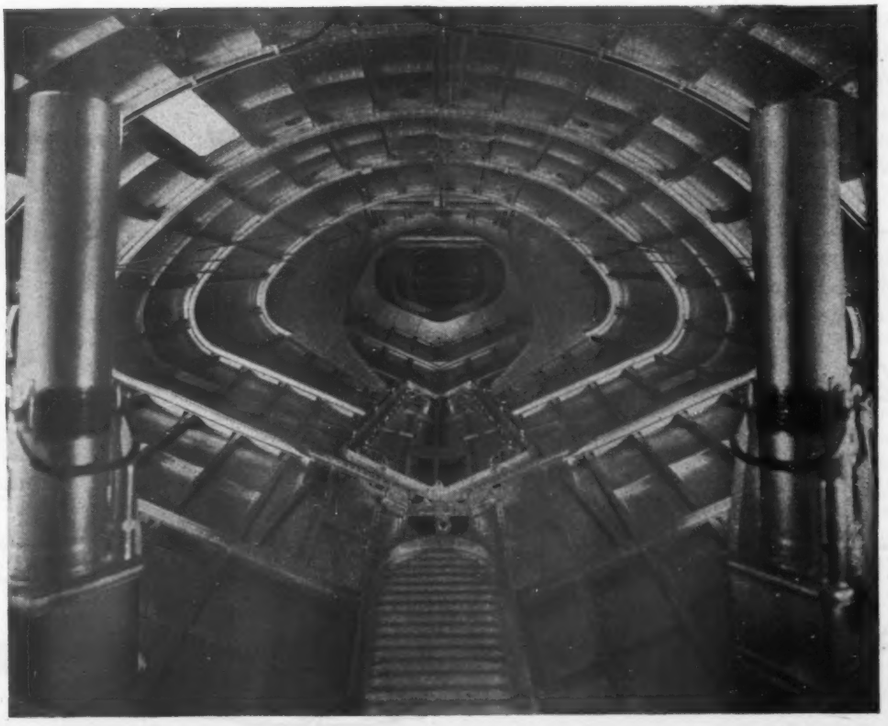


The landing gear of the Ryan STM-2 is of the treadle type with mechanically operated multiple disc brakes and long stroke oleo and spring shock absorbers. The structure of the landing gear is of built up welded tube sections over which is fastened a 24ST Alclad fairing. The triangular section behind the shock strut is fabric covered. The Shock strut is fastened to the fuselage through a hinge fitting, the unit being made stable through the use of streamlined stay wires that attach to the fuselage on one side and the wings at the other. Tread of the landing gear is sixty-six inches.



Although the Consolidated Model 28 twin engine flying boat has been in service for a number of years the method by which the wing tip floats are retracted is not widely known. When lowered in the position for landing the float is held in a vertical position through a system of "X" bracing that is joined together at point A. When lowered this bracing is held rigid through an arm B that is connected to the retracting tube at C. When the float is to be retracted the retracting tube moves towards the fuselage moving the arm B upward and inward folding the members D together. This causes the float to swing from the position E to the position E' in which position the drag is greatly reduced.

Looking aft inside of the fuselage of the Model 28 shows the Zee stringers running lengthwise and the beltframes running crosswise. The large bulkheads in the rear are the 'banjo' bulkheads which extend on up into the fin structure. The tunnel door or hatch is shown on the keel while the two vertical tubes in the foreground are flare tubes.



The STEARMAN FAMILY NOW WELCOMES VENEZUELA

NOW comes Venezuela . . . to take its place in the long line of nations whose flyers are trained in Stearman aircraft . . . to follow the example already set by the U. S. Army Air Corps, the U. S. Navy, the Brazilian Army Air Corps, the Cuban Army Air Corps, the Argentine Ministry of Marine and the Philippine Army Air Corps. In placing its order for Stearman Trainers, the Venezuelan Army was guided by the enviable record of Stearman in the field of primary and advanced training planes, all built in accordance with exacting requirements of the U. S. Army and Navy. Now under construction in the expanded plant facilities of the Stearman Aircraft Division is the largest peace-time order for trainers ever placed by the United States government. With these airplanes the Army is providing primary training for the new pilots who aspire to fly such mighty monarchs of defense as the giant 4-engine Boeing Flying Fortresses.

Boeing has always built tomorrow's airplanes today!

In the unusual photograph above are shown the rudder identification markings of the U. S. Army Air Corps, the Brazilian Army Air Corps, the Cuban Army Air Corps and the Venezuelan Army, as they appeared on Stearman Trainers recently delivered to these nations.

Stearman final assembly lines.

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SEATTLE, WASHINGTON

BOEING

STEARMAN
AIRCRAFT DIVISION
WICHITA, KANSAS

U H F

PART III

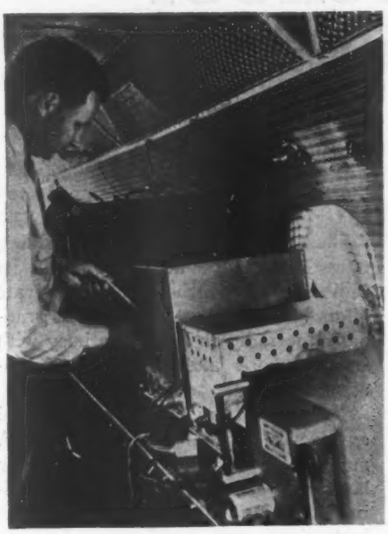
These articles on u-h-f- for aircraft are significant as frequency modulation makes its bid against other broadcast systems. No move has yet been seen to deprive aviation of its u-h-f assignments, and this third article deals with Radioteletype and Radiotelephone Ground - to - Ground, Ground - to - Aircraft

By W. E. Jackson

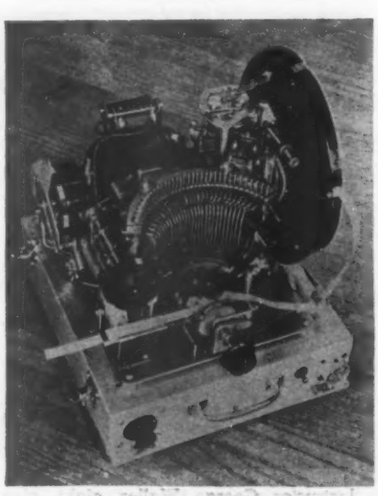
Chief, Radio Development Section, C.A.A.

WHEN scheduled airline operations were started in the United States, the Government established a teletypewriter communication service to provide the necessary meteorological and aeronautical ground communications. Weather and other necessary information is today disseminated over the entire Federal airways system. Over 23,000 miles of telegraph line are leased for this purpose at a total cost of over $700,000 annually. In an effort to reduce this cost and at the same time furnish additional and more reliable service, a multiple channel radio teletypewriter and simultaneous voice communication system was developed.

Experiments were started in 1930 using a radio system utilizing a frequency of 284 kilocycles, but this was unsuccessful because of high static levels occurring during the summer months. In 1932 tests were conducted using the 3 to 4 megacycle band; these also proved unsuccessful because of noise, fading, and multipath propagation. In 1935, an experimental circuit operating in the 60-66 megacycle band was installed with stations near Washington, D. C., and Baltimore, Md., a distance of 38 miles with the antennas approximately 600 feet below line of sight. The transmitters were crystal controlled and supplied approximately 100 watts of power to a directional antenna system. The antenna system, erected on top of 125 foot steel towers, consisted of four horizontal one-half wavelength radiators separated one-half wavelength vertically and fed in phase with a similar array as a parasitic reflector. The receiving antenna also on a 125-foot steel tower was of the rhombic type, two wavelengths on a side. Crystal-controlled superheterodyne receivers with concentric line tuned circuits in the radio frequency portions were used. The terminal equipment was developed to use standard teletype equipment and wire line procedures were simulated. Three years of successful operation of this circuit proved the reliability of the system and the desirability of using ultra-high frequencies with their low noise level, freedom from sky waves and minimum of fading for this point-to-point ground service. In 1939, a system was demonstrated at Washington which provided ground-to-aircraft teletypewriter service in which the pilot received printed copies of weather information and other communication data while in flight. At the present time, work is progressing rapidly on a program for the installation of a radioteletype and telephone circuit between Washington, D. C., and La Guardia Field. This will provide a ground-to-aircraft teletype channel, a ground-to-aircraft voice channel and two ground teletype channels. The installation will include two terminal stations, four intermediate stations, and one automatic repeater station with all transmitting and receiving equipment operating unattended and will eventually replace the present wire line teletype circuits used for the collection of weather information and traffic control operations.



Aircraft Radioteletype Installation



Aircraft Radioteletype Printer

The crystal-controlled transmitters operating in the 60-66 megacycle band will furnish 300 watts of power to an antenna with bi-directional radiation characteristics consisting of four one-half wavelength antennas excited in phase and separated one-half wavelength in the vertical plane. Continuous operation of the circuit will be insured by providing duplicate transmitters with automatic changeover to the spare unit in case of failure of the main transmitter.

A single rhombic type receiving antenna will be used for simultaneous reception from two directions each on separate frequencies. Frequency selective terminations for the ends of the antenna will produce the same results that would be obtained from two separate antenna systems aimed in opposite directions. The transmitting and receiving antennas will be erected on a single 200-foot steel tower. The topography between Washington and N. Y. C. is such that with 200-foot towers line-of-sight conditions will exist over six of the seven separate circuits of the system. A fixed tuned crystal-controlled receiver will be used for each frequency.

Each teletype channel will consist of two tones. Transmissions from north to south will use tone A, those from south to north tone B. With this system, wire line procedures can be exactly simulated.

In conclusion it should be stated that the field of aeronautics has furnished the major initial impetus for the development and application of ultra-high-frequency radio. Resulting progress in the radio art has in turn made available valuable aids in the advancement of the flying art.

Spartan's Radio School

By Maxwell W. Balfour
Director, Spartan School of Aeronautics

AN important personnel shortage in aviation today is due to the lack of trained radio technicians. Letters from employment managers of airlines, airports, manufacturers and the government all tell the same story, "We need men who know aviation radio."

Spartan School of Aeronautics, of Tulsa, Okla., recognized the inevitable shortage of radio men four years ago when it opened its first course in radio work. George Waller, with twenty years of experience behind him, supervises the department. He had not been at the school long before word was spread through the Middle West that Spartan had a well-equipped shop and could be prevailed upon to do radio service work. Hanford Airlines, now Mid-Continent, brought in its radio sets for overhaul. Then private pilots began asking for help and gradually the radio shop became busy with service work and obtained government approval.

Radio students also get practical experience in the building of sets. A number of transmitters have been built at the school that have a sending range of 1,000 miles for use in both single and multi-motored ships.

Students get practical instruction in communicating with solo flight students, under airline operating conditions.

Instructor George Waller, right, gives a lesson in transmitter-receiver work.

In radio code class students learn to handle code to meet airline standards.

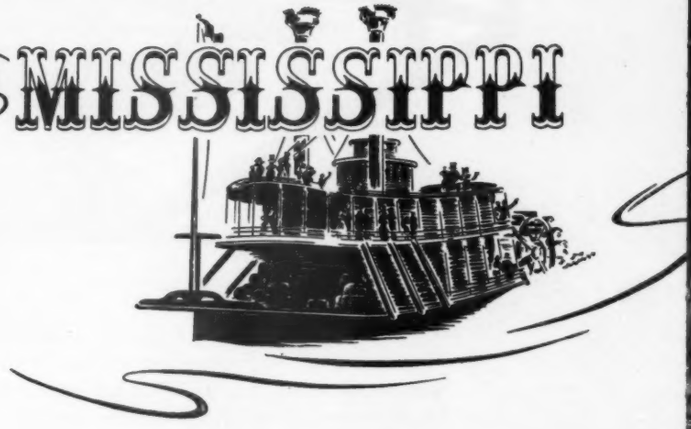
The latest project has been the development of a light, two-way radiotelephone set for small private planes.

The size of the radio shop and the amount of special equipment has grown steadily. More than $16,000 worth of radio equipment for student use is now on hand. This includes a 900-watt telephone and code transmitter, ultra-high frequency phone transmitter used for transmitting instructions to pilot students during primary solo flights, and the latest type fourteen-tube communication receiver equipped with beat oscillator and crystal filter for code reception. This receiver enables radio students to learn how to operate the type used by the major airlines. Another receiver constructed by the Spartan School laboratories is used especially for receiving the range and weather stations. In one of the modern classrooms are two tables equipped with telegraph keys and audio-oscillator for code instruction.

For test work there is a screened room; oscilloscope for delicate adjustments in frequency, a frequency modulator used in conjunction with the

(*Turn to page 128*)

MODERN LIFE on the MISSISSIPPI



CHICAGO & SOUTHERN INTRODUCES NEW DOUGLAS DC-3's WITH 1200 h.p. WRIGHT CYCLONE ENGINES

NOT so many years ago, feats of the famous river packets made folk-lore along the great Mississippi, and Mark Twain, himself a river pilot, wrote this stirring era into the country's literature. Today the basis of a new chapter in Mississippi history is being provided by the Chicago and Southern airliners which follow "The Valley Level Route" above the majestic Father of Waters.

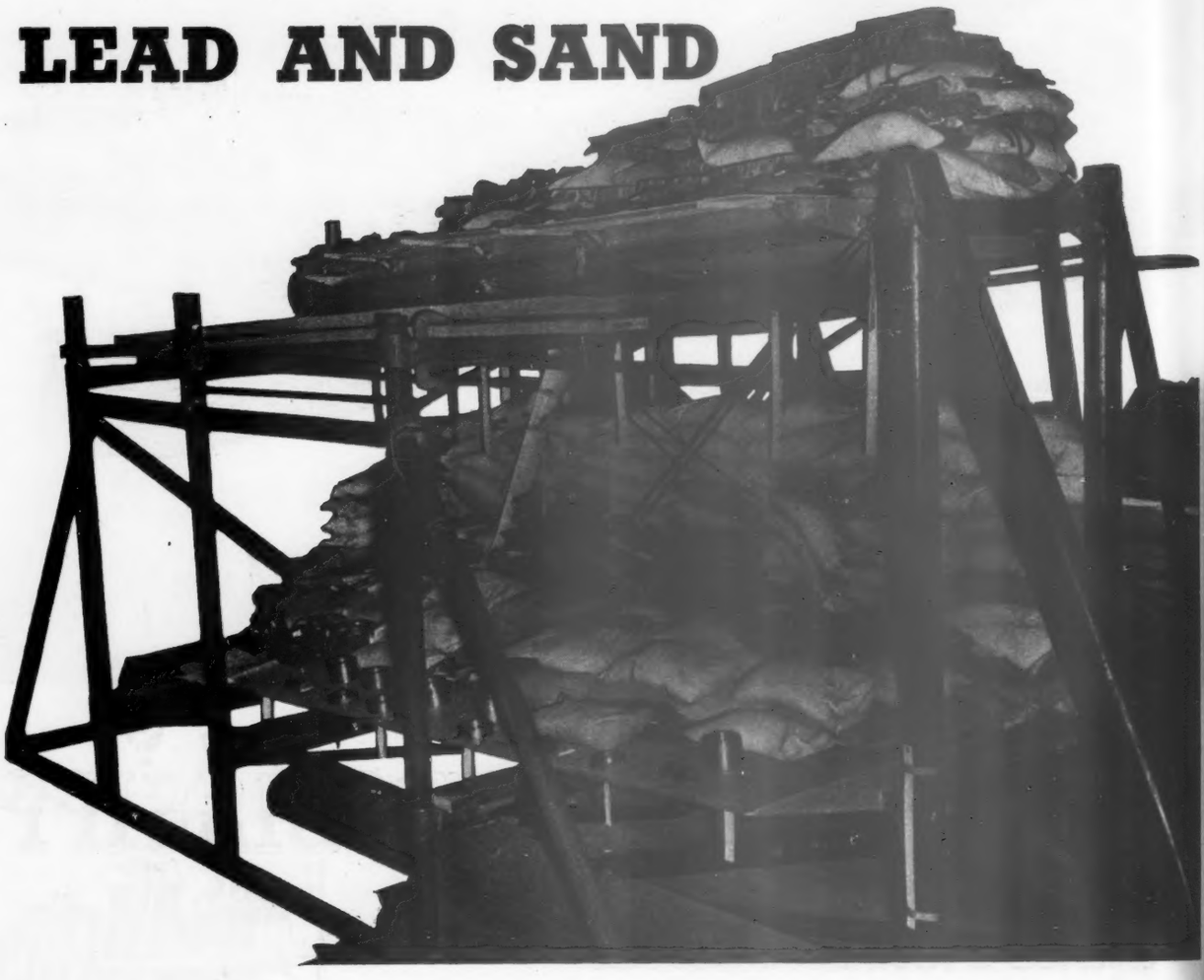
Chicago and Southern's latest contribution to modern life on the Mississippi is a new fleet of Douglas DC-3's now in operation between Chicago and New Orleans. Powered with 1200 h.p. Wright G-200 Cyclones—the most powerful of the single-row Cyclone series—these luxury ships bring a new conception of speed and performance. Service by attractive stewardesses provides a degree of comfort unheard of in Mark Twain's day.

Chicago and Southern Airlines, long a user of Wright Whirlwinds in its fleet of Lockheed Electras, now joins the growing list of Cyclone operators who have given this engine an unapproached record in the transportation field.

WRIGHT AERONAUTICAL CORPORATION • *A Division of Curtiss-Wright Corporation* • **PATERSON, NEW JERSEY**

WRIGHT *Aircraft* ENGINES

LEAD AND SAND



This photograph shows lead bars and sand bags piled in tiers on the wings of a BEECHCRAFT biplane attached, in an inverted position, to a massive steel testing jig.

The practice of static testing is not remarkable or unusual. What makes this test unusual is that *the wings under test are more than 40 months old.*

The purpose of the test was to determine if protective finishes and methods used in BEECHCRAFT structures would cause them to retain their originally designed strength over a period of years.

For a continuous period of more than four hours the designed ultimate breaking stresses were imposed on these wings. *Further weights were added until the stresses were 900% of normal full-load flight conditions.* This was equivalent to a "9g pull out." No breakage occurred. When the weights were removed the wings were uncovered and carefully inspected. All parts were intact and in their proper places and no signs of damage could be found.

This sort of testing is expensive, but proves beyond a shadow of a doubt that BEECHCRAFTS are built to render lasting safety and trouble-free operation.

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BEECH AIRCRAFT CORPORATION

THE LASTING STURDINESS OF ALL BEECHCRAFTS IS MATCHED BY THEIR EXCEPTIONAL PERFORMANCE—ASK YOUR BEECHCRAFT DEALER FOR A DEMONSTRATION

THIS BIG H·P·M PRESS PRODUCES THOUSANDS OF AIRCRAFT PARTS • • •

This 2000 ton H-P-M Press has ample power and area for forming large aircraft parts by the accepted methods, as well as miscellaneous small parts in multiple. ● Although H-P-M has built the largest aircraft press in operation in the United States, it recommends this standard 2000 ton press for average requirements. ● Today nine of these H-P-M Presses are proving their production and operating advantages. Write for complete information today.

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District Sales Offices: New York, Syracuse, Detroit and Chicago

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PESCO PRODUCTS *help the pilot take his ship "Upstairs"*

Announcing a NEW DRY AIR PUMP

Out of the PESCO engineering laboratory comes this new Dry Air Pump featuring these unusual advantages:

- Delivers OIL-FREE air to De-Icers
- Eliminates oil from De-Icer boots
- Extends life of De-Icer boots
- Requires no oil separator
- Provides suction for flight instruments

• Oil-free air discharge is achieved by a special design whereby lubrication is excluded from air chamber.

• As the pilot of this new Chicago & Southern DC-3 opens his throttle for the climb, he is secure in the knowledge that PESCO fuel pumps and accessories are performing with their customary dependability. Proper fuel delivery is of utmost importance as the great transport goes "upstairs."

Other Pesco Products at work during this crucial period in the flight are Vacuum Pumps activating flight instruments and Hydraulic Pumps retracting landing gear. » » » » »

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PESCO

Southwest Aviation Conference

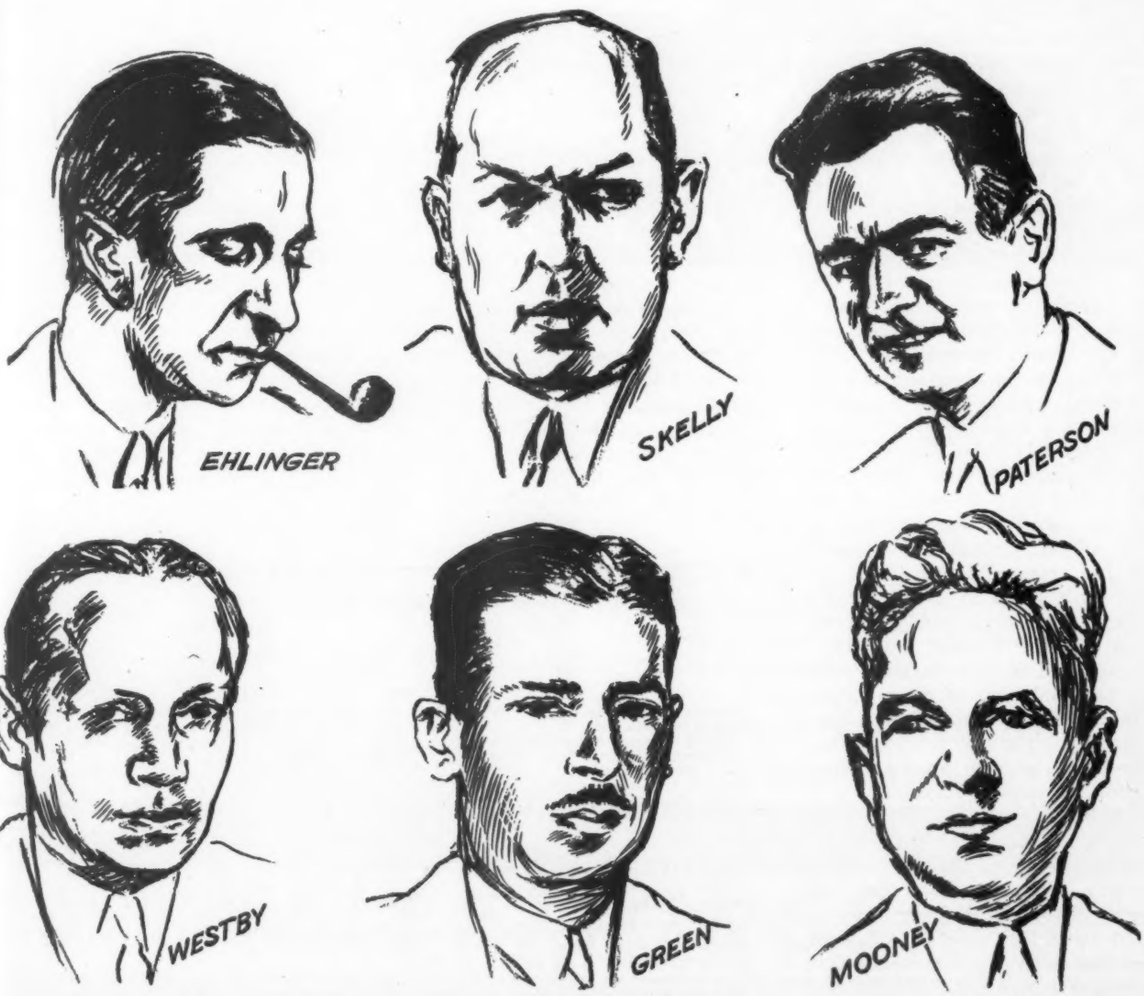
Successful meeting at Tulsa provides new impetus to aviation growth.

TYPIFYING the tremendous interest in aviation affairs which is now sweeping the country, the third annual Southwest Aviation Conference held in Tulsa late in April was far more successful than either of the earlier conferences. Aviation officials representing all branches of both civil and military activity as well as many persons from outside the industry, journeyed to Tulsa for the three day meeting.

Men pictured below played a prominent part in the meetings. W. G. Skelly was elected president, succeeding Moss Patterson who has handled affairs so well in the past. Bill Skelly has had a wide experience in aeronautical work as he is president of Spartan Aircraft School and is head of the oil company bearing his name.

Among the Conference recommendations was that if Congress vote additional funds for new research laboratories, the labs should be located in the interior sections of the country. Congress was petitioned to approve the McCarran and Houston bills for additional airport construction. Senators and Representatives from the Southwest were petitioned to back new feeder lines for their sections of the country.

CAA was urged to discard the present teletype weather collection service in favor of a group collection service such as was used prior to last November. Members of the conference agreed to work for the establishment of additional aircraft and engine factories in the southwest.



Stocks Behave like War Babies

By Selig Altschul

THE intensification of European hostilities led to some violent market movements, with the aircraft stocks acting in true "war baby" fashion. In the market session of May 13, and 14, with the industrial average off more than 16 points, aircraft issues were in the vanguard of sharply declining prices. That "war babies"—particularly aircrafts—should turn decidedly reactionary in the face of record backlogs, is an anomaly that baffles many an observer.

The unpleasant possibility of an Allied defeat, or speculation as to this country's entry into the conflict, may have been factors leading to a bearish view. The fact remains, however, that with the Allies revealed as sadly deficient in aircraft, they will be required to accelerate the rate of plane purchases made in the United States.

It is now more or less generally known that the Allies have only recently signed contracts for a total of 4,400 major type airplanes. Thus far, this is the only tangible result of the widely heralded 10,000 plane order discussed at the outset of this year. With extensive aerial warfare, it is likely that total needs for 1941 will exceed the original 10,000 expectation by a wide margin.

Unofficial reports award the placement of this new group of orders with Douglas, Curtiss-Wright, Martin, Lockheed, and Bell. The belief is also held that Secretary of the Treasury Morgenthau, in general charge of all government procurement, has repeatedly urged that the Allies place prorated orders among the some 30 aircraft builders in the United States. Instead, the Allies have persisted in concentrating their order with only five of the manufacturers capable of turning out planes in quantity. Such a procedure has resulted in stimulated plant and payrolls for the larger companies.

It is reliably reported that recent expansion of plant facilities undertaken by two engine builders, United Aircraft's Pratt & Whitney, and Wright Aeronautical, have been financed by Allied orders. It is believed that within a few weeks both Pratt & Whitney and Wright will each be turning out about 1,200 engines of more than 1,000 hp. per month. General Motors' Allison Engineering Division is rated with a present capacity of about 3,500 engines a year. This company, preparing for Allied demand, is planning to double its present capacity to approximately 7,000 units a year. These recent expansions should do much to relieve the bottleneck of slow engine production reported a few months ago.

The backlog of aircraft orders, according to recent estimates, is believed to aggregate more than $850,000,000. Should further Anglo-French business materialize as anticipated, peak operations for the aircraft industry beyond 1941 appears assured.

Exports of aircraft from this country may not show any sharp increase until June at least. Shipments of aircraft during the first quarter were moderate. January, February, and March totals fell below that of December, 1939, when $28,894,000 of aircraft was exported.

In any event, the output of planes and engines for the first half is expected to exceed the $225,000,000 produced for all of 1939. Operations should continue to rise steadily over the course of the next few months, making possible a total production of more than $600,000,000 for 1940 as a whole. This total does not include a substantial amount of propeller and other parts business. During 1939 these parts accounted for about 20 per cent of total aircraft and equipment sales.

Companies having foreign contracts may realize profit margins, before adjustments, ranging from 25 per cent to 30 per cent. Such export business should permit sharp increases in net earnings for the builders involved. Moreover, it is interesting to observe that those companies who have thus far obtained the bulk of foreign business will probably continue to do so. Other aircraft units, however, may participate in this volume. For example, Douglas is reported as planning to sublet a part of the indicated $112,000,000 order recently received from the Allies, to Boeing and Consolidated. North American Aviation may be a subcontractor for about 600 of the 1,500 pursuit planes order received by Curtiss-Wright. Lockheed may pass along part of its order for 1,200 planes valued at about $100,000,000 to Vultee Aircraft and Vega Airplane.

Happily, or otherwise, the volume of business is such that the industry can well afford to be generous in distributing orders within itself.

The market seemingly took little cognizance of the fight surrounding the change in the status of the CAA. Yet, air transport investors could do well to reflect on any move that affects the regulatory processes of an industry, especially at a time when many of its economic policies are still in the formulative stage.

The airline passenger rate structure submitted to a significant innovation when United Air Lines introduced two rate schedules on its San Francisco-Los Angeles route. As it is the only

(Turn to page 130)

Airline Earnings

	March		1st Quarter		Revenue Passenger Load Factor (%) 1st Quarter	
	1940	1939	1940	1939	1940	1939
American Airlines, Inc.	$246,810	$ 56,235	$370,853	$ 28,200	63.20	53.41
Braniff Airways, Inc.	8,867	d 8,736	d 28,291	d 8,982	51.23	53.31
Chgo. & Southern Airlines, Inc.	933	5,462	1,863	2,537	66.17	47.19
Continental Air Lines, Inc.	3,670	3,937	1,515	5,037	39.01	27.76
Delta Air Corporation	d 1,028	4,318	427	2,037	53.09	44.08
Eastern Air Lines, Inc.	333,927	128,217	720,413	294,120	62.04	60.79
Inland Air Lines, Inc.	d 4,554	d 3,830	d 23,488	d 21,719	20.23	12.23
Mid-Continent Airlines, Inc.	d 4,791	d 6,553	d 15,257	d 34,864	30.11	27.55
National Airlines, Inc.	10,934	2,554	27,124	2,817	57.26	35.60
Northwest Airlines, Inc.	d 18,244	d 54,803	d 99,249	d180,123	30.97	32.57
Pennsylvania-Central Airlines Corp.	27,040	527	d 43,458	d 44,295	46.09	50.91
Transcontinental & Western Air, Inc.	d 77,417	d 81,351	d391,459	d364,841	45.47	37.56
United Air Lines Transport Corp.	13,941	d 52,191	d296,943	d421,657	53.84	51.26
Western Air Express Corp.	23,686	d 4,172	19,255	d 42,434	41.20	23.85

NOTE: Above compilations based on monthly reports filed with the CAA and are before provision for Federal Income Taxes.
d — Deficit.

Henry Becker Operating one of Fleetwings' many Precision Machines.

Men and Machines

CONTRIBUTING TO AMERICA'S SUPREMACY IN THE AIR · · ·

FLEETWINGS HYDRAULIC SELECTOR VALVES

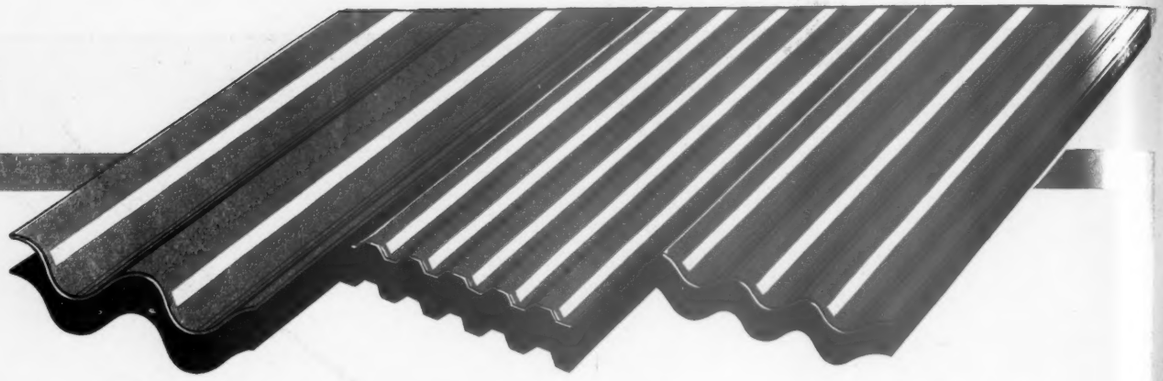
WITH the loyal cooperation of skilled, efficient workers, and the installation of the latest developments in precision machinery and equipment, Fleetwings is taking an increasingly active part in the tremendous development of Aviation in America.

As manufacturers of Stainless Steel and Aluminum Alloy Fixed and Movable Surfaces, Hydraulic Valve Equipment, and many other Stainless Steel and Aluminum Alloy Parts, we are highly appreciative of the recognition that Aircraft Builders have given to us.

DESIGN · ENGINEERING FABRICATION

FLEETWINGS INCORPORATED

BRISTOL, PENNA.



NEW WRINKLES

AND WHAT THEY MEAN

Meaning as Wrinkles: With new, more powerful equipment now being installed, it will be possible to produce Alcoa Aluminum Alloy corrugated sheets in a variety of forms previously unavailable. Sheets of stronger alloys, larger size, greater thickness and deeper corrugations may be made. The same equipment will also be capable of forming sheet into special shapes such as channels and angles.

Meaning for Aircraft Design: With this new larger, stronger, and thicker Alcoa Aluminum corrugated sheet, it will be possible to make improvements in aircraft design which bring advantages both to manufacturer and to operator.

And a Major Meaning: A lot of money went into development, design, and building of these corrugating machines. This expenditure follows a policy, and a program. The policy is a broad one of exploring every new avenue of usefulness for Aluminum. The program is to provide plant equipment to keep the production of Alcoa Aluminum Alloys a step ahead of the normal needs of dynamic, progressing industry. It's a matter of doing everything possible to give you Aluminum in the forms you need for the best aircraft that can be made. ALUMINUM COMPANY OF AMERICA, 2182 Gulf Building, Pittsburgh, Pennsylvania.

ALCOA ALUMINUM

RESEARCH

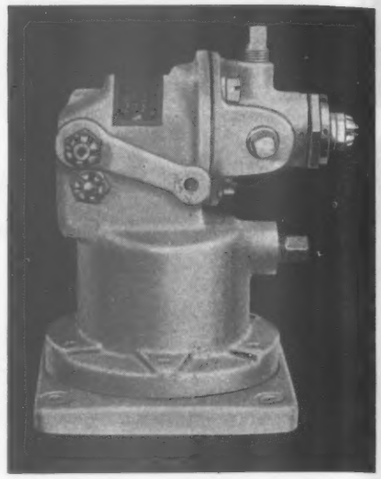
NORTH AMERICAN AVIATION, INC.

INGLEWOOD, CALIFORNIA, U.S.A.

BUYER'S LOG BOOK

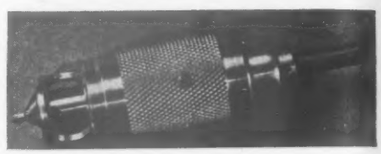
What's New in Accessories, Materials, Supplies and Equipment

A system to help the operation of engines at more stable temperatures and to help operate through icing conditions has been developed by the Fuel Development Corporation of New York, New York. Two mixtures of their product, called "Anilol" have been developed. Number 4 is for direct mixing with gasoline and is used principally for racing purposes while number 3 is used with a metering valve for automatically raising the octane value of gasoline for take-off and de-icing carburetors. This valve so controls the flow of Anilol that the quantity is increased with the output of the engine without any attention from the pilot.—AVIATION, *June, 1940.*



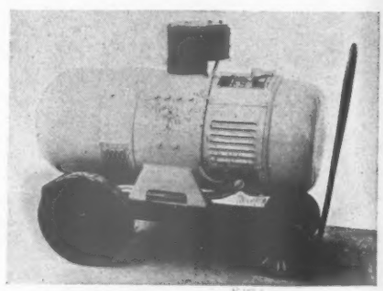
Anilol automatic metering valve.

General adoption of flush-type countersunk rivets by the aircraft industry has made rapid and accurate countersinking of rivet holes an important operation. Patents have been applied for by Aircraft Tools, Inc., Los Angeles aircraft tool manufacturer, on an entirely new stop countersink for use with an electric drill. The tool is exceptionally smooth and fast in operation because of incorporation of full ball bearing mounting of the countersink head. This countersink can be adjusted for depth to within .0005 in. and stays locked in position. Adjustment is quickly made by hand. Cutters are three-fluted high speed steel, ground for correct cutting angle, with removable pilot. Concentricity is held to within .001 in.—AVIATION, *June, 1940.*



Power countersink.

Increasing use of arc welding in aircraft construction has revived interest in this process among aviation people. Latest "speed-up" device applied to arc welding is the new Wilson remote control device used with the Wilson "Hornet" Arc Welder, manufactured by the Wilson Welder and Metals Co., Inc., New York, N. Y. To use this device the handwheel which governs the control pole of the standard welder is replaced by a reversible electric motor control. Minute adjustments in current output can be effected by touching one of two contacts on the electrode holder to the ground. When the holder button marked "more" is touched to the floor the output is increased. When the button marked "less" is grounded the output is reduced. An automatic slip clutch and stops protect the motor mechanism.—AVIATION, *June, 1940.*



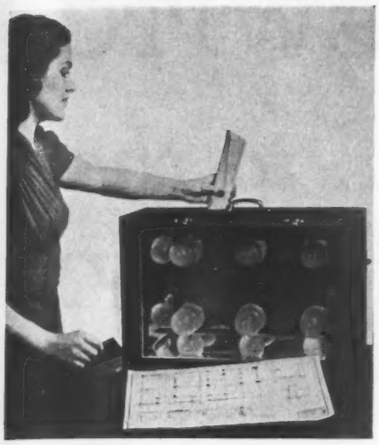
Wilson "Hornet" arc welder.

Despite the wide adoption of router head contouring machines to aircraft sheet metal profiling operations, there is still a large field for the good old nibbling machine. Not only is such equipment used in many of the smaller plants, but wherever complex outlines must be profiled on but a few parts the nibbler is in its element. Pioneer builder of nibbling equipment, the W. J. Savage Company of Knoxville, Tenn., has recently incorporated numerous refinements in its latest line of nibblers. Built in cutting capacities in mild steel up to $\frac{7}{8}$ in. thickness, and with throat depths up to 36 in., Savage nibblers have a direct-over-center-drive and patented tool holder which makes it possible to cut stainless and other alloy steels, as well as the lighter alloys.—AVIATION, *June, 1940.*

Savage Nibbling Machine.

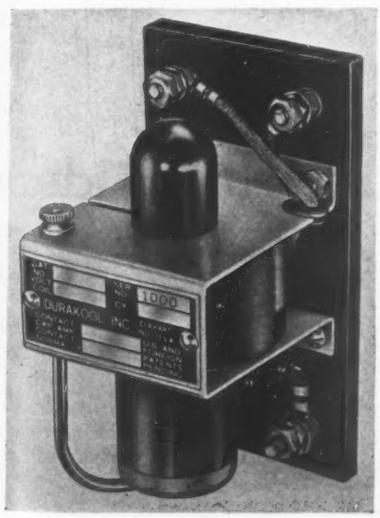
With aircraft factories expanded to the point where it is necessary to use roller skates to commute from one part of the plant to another there is reason for special interest in the new Elpro Portable Printer announced by the Ozalid Corporation of Johnson City, New York. This little printer will reproduce engineering drawings, letters, reports, maps, or any pencil or ink lines, typewritten or printed matter appearing on but one side of a reasonably translucent sheet of paper. A dry developing chamber, located behind the metal reflector, utilizes the heat generated by the lights to vaporize the developing agent. The unit is light and portable, so that it may be carried from place to place for use in various offices or departments of the factory.—AVIATION, *June, 1940.*

Finger-tip controls with a minimum of friction and wear, resulting in reduced cable maintenance, are claimed for the new SKF pulley bearings manufactured by SKF Industries, Inc., Philadelphia, Penn. These AN standard bearings are supplied in three types; the deep groove ball bearing, the self-aligning



Ozalid Elpro Portable Printer.

SKF control pulley bearing.



Durakool mercury relay.

Aeromac electric hydraulic valve.

ball bearing; and the cylindrical roller bearing. All are of the full type, employing the maximum number of balls or rollers without retainer, permitting high loads with minimum weight. Two dustplates retain lubricant in the bearing. Sheaves of a lightweight plastic impregnated fabric, or of aluminum alloy, are available.—AVIATION, *June, 1940.*

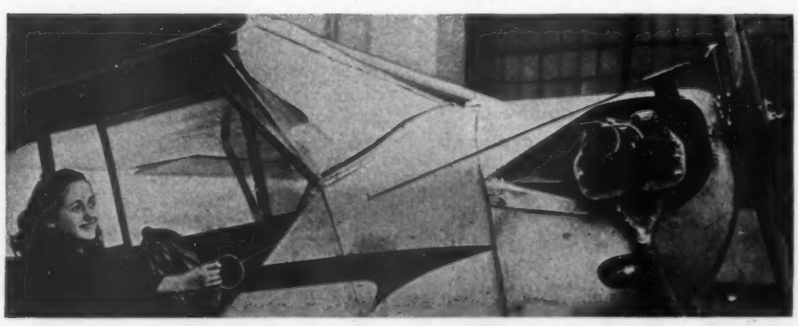
As aircraft grow more complex an increasing amount of study and engineering must go into their various actuating systems. Electric relays have played an important part in making practicable remote control actuation of various devices such as retractable flaps and landing gear. Now a mercury relay utilizing the unbreakable metal body of the Durakool mercury switch, and the displacement principle with solenoid actuation has been developed by Durakool, Inc., Elkhart, Indiana. The relay is hermetically sealed, may be operated up to 300 times per minute, has very little friction or wear in operation, is of compact and rugged construction, requires little or maintenance —in fact, it's a good relay. On A.C. current as little as 1 watt is required for normal closing operation and only 1.5 watts for normal opening operation. On D.C. the operating energy required is but .25 watts.—AVIATION, *June, 1940.*

Possibilities of remote electrical control of hydraulic valves on aircraft hydraulic systems are illustrated by the operation of the Aeromac oil dilution valve developed by the Aeronautical Manufacturing Corporation, Buffalo, N. Y. Operated by an electric solenoid, this valve was designed for diluting crankcase oil with aviation gasoline, to assist in cold weather starting. The valve is light, compact, and efficient. Tests have been run to in excess of 26,000 cycles under 50 lbs. per sq. in. pressure without evidence of wear or leakage. Satisfactory operation has also been obtained at pressures up to 800 lbs. per sq. in., and the valve has proved tight against oils, gasoline, and gases.—AVIATION, *June, 1940.*

Application of the electric starter to the automobile is said to have done more than anything else to popularize that vehicle. Lightplanes are still started by hand cranking the propeller, an awkward and somewhat dangerous operation. Development of suitable electric starters for lightplanes has been slow because of cost and weight, but it may be that a mechanical starter permitting the pilot to spin his motor from the seat of the plane will do much to solve this lightplane starting problem. Such a starter is now being offered by Aero Starters of Pittsburgh, Penna. The device is quite simple in design, consisting of a ratchet and lever arm working on the propeller shaft. A pull rod extends back into the cabin permitting the pilot to spin the engine manually without inconvenience or danger.—AVIATION, *June, 1940.*

Light-weight, wind driven generators, at prices within reach of all lightplane owners, have been introduced by Champion Aviation Products Company, Los Angeles, Calif. Six-volt models are available in 6, 12, and 20 ampere capacity, weighing 6, 9, and 13 lb. respectively. The 12-volt models are available in 4, 8, and 15 ampere sizes, and weigh the same as the corresponding 6-volt models. Voltage, control and relay prevents overcharge and, on the four larger models, the propeller pitch can be adjusted to give maximum output under all variations of cruising speeds.—AVIATION, *June, 1940.*

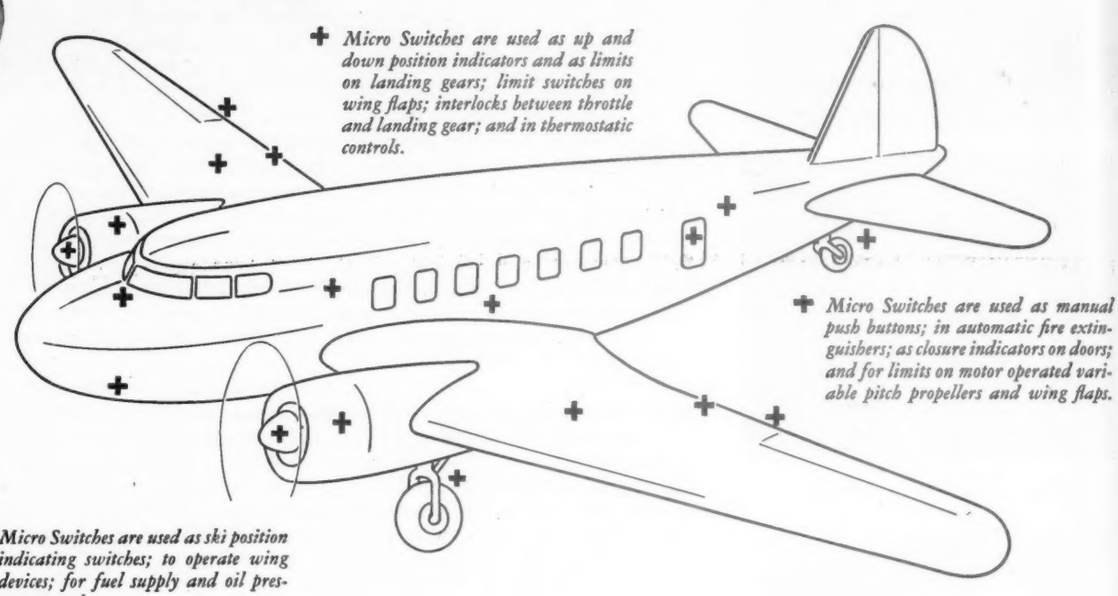
(*See page 105 for Window Shopping*)



Aero lightplane engine starter.

MICRO SWITCH

. . . A Boon to the Aircraft Industry



✚ *Micro Switches are used as up and down position indicators and as limits on landing gears; limit switches on wing flaps; interlocks between throttle and landing gear; and in thermostatic controls.*

✚ *Micro Switches are used as manual push buttons; in automatic fire extinguishers; as closure indicators on doors; and for limits on motor operated variable pitch propellers and wing flaps.*

✚ *Micro Switches are used as ski position indicating switches; to operate wing devices; for fuel supply and oil pressure control.*

Now Being Used by Leading Aircraft Builders

Small size: 11/16" x 27/32" x 1 5/16". Weight: 1 oz., without special mountings, actuators or housings. Energy requirements: .004 to .0004 ounce inches. Unaffected by temperature and altitude. Available with various pretravel or overtravel plungers, close or wide differential movement. Resists vibration; meets "10-G" test. Operates in any position. Fast and positive operation. Accepts standard aircraft terminals. Also available in metal housings.

● Leading aircraft builders' use for Micro Switches has grown rapidly during the past few years. Many switches are used on each plane at functional points where certainty of performance is a "must."

Micro Switches were adopted for use on airplanes after having been thoroughly proved in a wide variety of industries where over a million Micro Switches are now depended upon for long life precision.

Aircraft engineers recognize that, in addition to the performance record of Micro Switches, they possess other characteristics vital to successful aircraft use—small size; light weight; accurate repetition of the point of operation; resistance to vibration; independence of position; and a versatile variety of possible adjustments and characteristics.

The illustration above indicates some of the places Micro Switches are now used. Many more applications are on the drafting boards, and in engineering plans, for reasons which the column at the left will make clear to every aviation engineer.

Micro Switch engineers are skilled and experienced in the solution of precision switch application. Their knowledge and assistance are available.

Copyright 1940, Micro Switch Corporation

MICRO MS SWITCH

TRADE MARK

Manufactured in FREEPORT, Illinois, by Micro Switch Corporation. Sales Offices: New York, Chicago, Boston

High Military Efficiency

IN RAPID MASS PRODUCTION

Now moving across America's largest aircraft assembly floor at a production speed hitherto unattained in the building of large military aircraft, the Martin Bomber Model 167W is a triumph of aeronautical engineering. Combining maneuverability, speed, and fire power in a high degree, and designed specifically for rapid mass production, this four-purpose military plane now is available for export.

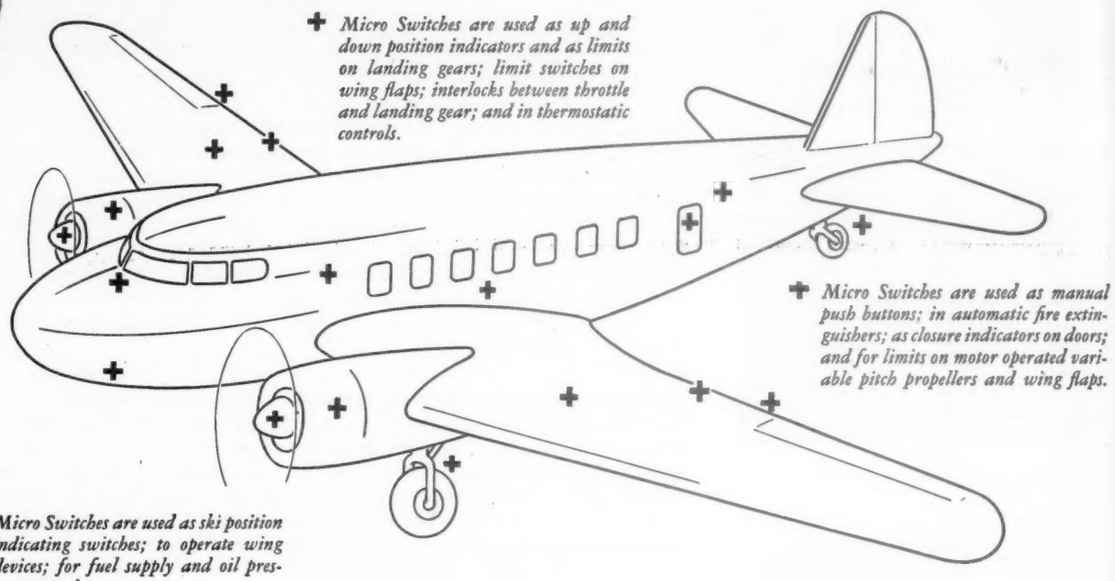
THE GLENN L. MARTIN COMPANY, BALTIMORE, MARYLAND, U. S. A.

BUILDERS OF DEPENDABLE AIRCRAFT SINCE 1909

TRADE MARK

MICRO SWITCH

. . . A Boon to the Aircraft Industry



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THE GLENN L. MARTIN COMPANY, BALTIMORE, MARYLAND, U. S. A.

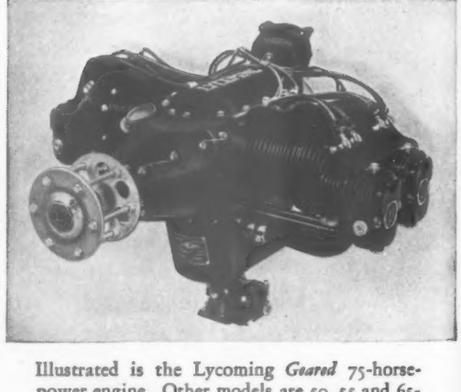
BUILDERS OF DEPENDABLE AIRCRAFT SINCE 1909

TRADE MARK

"Dependable as a Watchdog!"

DEPENDABILITY is the foundation upon which all aircraft engines should be built. And throughout the aviation world Lycoming light-plane engines have become a standard by which to measure dependability. A broad background of experience in the manufacture of engines for military, airline and commercial use is reflected in Lycoming light-plane engines . . . practically designed, skilfully engineered and precisely built to the highest standards of construction. No wonder experienced pilots tell you that Lycoming is "dependable as a watchdog"—just as they say it is "smooth as satin" . . . "quick as a cat" . . . "thrifty as a Scotchman" . . . "quiet as a mouse"! Performance as brilliant as a star is readily verified behind a Lycoming engine in a Taylorcraft, Aeronca, Piper Cub or Luscombe.

SEND FOR FREE LITERATURE: Illustrated folders on Lycoming light-plane engines may be obtained from all Taylorcraft, Aeronca, Piper Cub or Luscombe dealers. Or write Department A740, Lycoming Division, Aviation Manufacturing Corporation, Williamsport, Pennsylvania, U. S. A. . . . Cable address: Aviatcor.



Illustrated is the Lycoming *Geared* 75-horsepower engine. Other models are 50, 55 and 65-horsepower. They are all four-cylinder, horizontally opposed, air-cooled—with your choice of either single or dual magneto ignition.

YOU CAN RELY ON

LYCOMING

50 to 300 H.P.

Engines

FOR MILITARY AND CIVILIAN TRAINERS ★ FOR PRIVATE AND COMMERCIAL PLANES

THE AVIATION NEWS

REVIEW, COMMENT, FORECAST

JUNE 1940

BLAINE STUBBLEFIELD
Washington

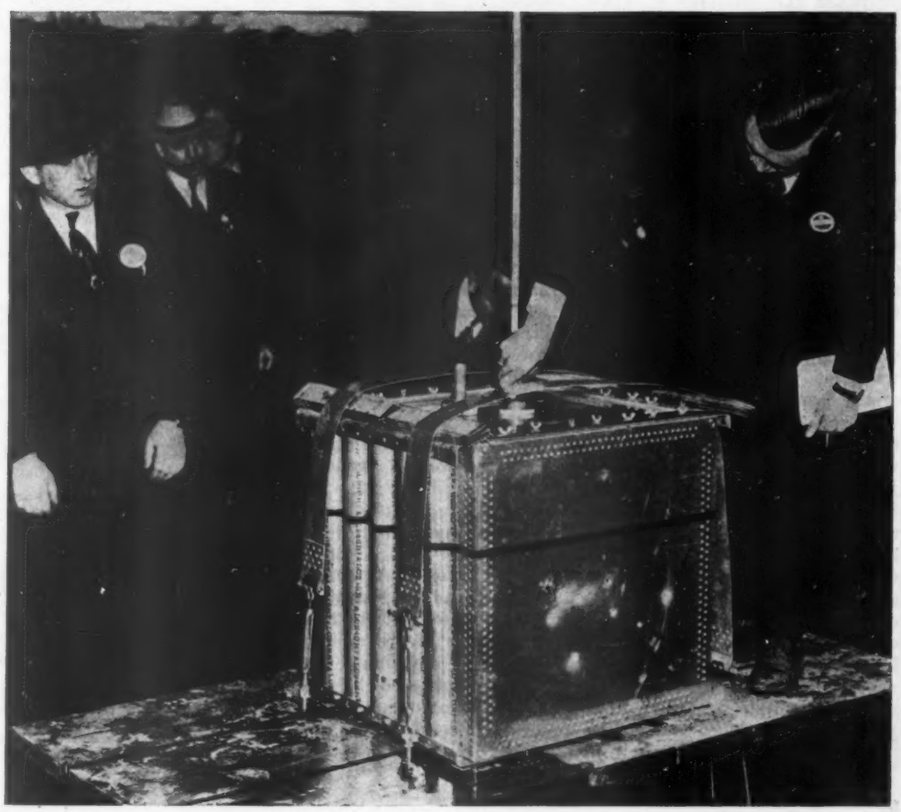
C. F. McReynolds, Pacific Coast
Jay P. AuWerter, New York
E. R. Lockin New York

FDR Wants Army Navy Airforce of 50,000

(Story on page 82)

International News Photo

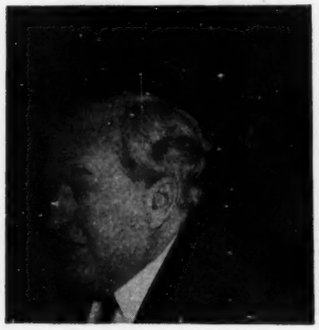
AS GERMANY CONTINUED to outfight the Allies, President asked Congress for a billion dollars in addition to two billion already appropriated for 1941, to expand our defenses. Pilot training will be increased threefold and more airplanes will be authorized for the Army and Navy. Secretary Charles Edison made headlines by saying officially what had already been said unofficially: that airplanes have a "temporary" advantage over warships, which should be redesigned for protection. President Roosevelt won his fight for transfer of the Civil Aeronautic Authority to the Department of Commerce. Above: is a British Bristol-Beaufort, said to be the fastest two-engine bomber in the world, which took heavy toll of Nazi planes over the low countries. It is the jack-of-all-trades of the RAF; is used for long-range bombing, torpedo bombing and general reconnaissance. The war in Europe recently brought out gas tanks that are self-sealing against bullets. Right: you see such a tank being examined at the Glenn Martin plant after it had been shot through. In addition to the puncture-proof gas tanks future production for the Air Corps will be equipped with cannon (guns that project explosive shells instead of bullets), with heavier machine guns, and with armor which will protect personnel and engines.



British Combine

NATIONAL AVIATION

President Roosevelt Wins in Senate CAA Goes to Commerce Department



Sen. Pat McCarran and Rep. Clarence Lea who braved the White House wrath in an effort to get a Congressional veto of President Roosevelt's transfer of the Civil Aeronautics Authority.

Washington (AVIATION BUREAU) —On June 11, less than two years after its installation under the new civil air law, the Civil Aeronautics Authority will become the Civil Aeronautics Board under control of the Department of Commerce, and the Air Safety Board will cease to exist. The safety functions of the safety board will be incorporated in the CAB.

After President Roosevelt proposed the transfer of CAA in his reorganization Plan IV, both Senator Pat McCarran and Rep. Clarence Lea offered resolutions in their respective houses to reject the plan. The House did reject it, by a vote of 232 to 153. But Mr. Roosevelt then made his proposal a personal issue and he turned the White House heat valve wide open against McCarran's resolution in the Senate. This resulted in a defeat for McCarran of 46 to 34.

Washington observers agreed unanimously that the battle was not waged on the merits of the issue. All agreed too that none of the reasons given by the President for the transfer were the real reasons. The majority believed that it was the first step in an unrevealed plan to consolidate all transportation agencies in the Department of Commerce, plus a personal desire of the Chief Executive to dominate as many federal agencies as possible. Mr. Roosevelt himself answered criticism by saying that objectors were ignorant, gullible or were completely partisan.

Hardly anybody was willing to predict immediate results of the President's victory. Opinion was, however, that there would be resignations from the Authority. Some said that if Robert Hinckley accepted the job offered him as Assistant Secretary of Commerce and was confirmed over sure Senate opposition, a fight between him and CAA might be expected.

The old battle for non-political control of civil aviation seemed to be starting all over again, with the certainty that a move will be made in Congress next year to regain independence for the Authority. Any accidents on the airlines are sure to be laid squarely on the doorsteps of the President and the Senators who approved his plan.

It appeared probable, as this was written, that FDR's Plan III, which gives the Administrator 90 per cent of the Authority's appropriations and 90 per cent of its personnel, equal almost to one-man control, would go into effect by default, on June 3. Opposition to it by Congress would seem futile, considering the crushing defeat of the resolution against Plan IV.

'40 Forum

Washington (AVIATION BUREAU)—"One of the most comprehensive exhibitions the world of aviation has ever seen," is how the National Aviation Forum, sponsored by the National Aeronautic Association, described itself. The show, with a huge exhibition of both civil and military planes and equipment, was getting ready to open as this was written. The dates were May 26–29. President Gill Robb Wilson, of NAA, said the Forum of 1940 was "above everything else for the American public."

Sessions, luncheons and dinners were held at the Willard Hotel; the airplane exhibit, in charge of jaunty, efficient Capt. C. S. Irvine of the Air Corps, was in two hangars and adjacent space at Bolling Field, Anacostia.

Among the exhibitors were Wright Aeronautical, Pratt & Whitney, Bendix, the Glenn L. Martin Co., Sperry Gyroscope. Other organizations taking part were NACA; Air Corps; Navy Bureau of Aeronautics; CAA; Weather Bureau; U. S. Travel Bureau; U.S. Office of Education.

An essay contest for students of all ages was sponsored by the Office of Education and handled by Dr. Robert W. Hambrook, Thomas H. Beck, publisher of *Colliers*, served as Forum chairman and was said to have backed it generously.

Coming Events

June 1– 2.	Air Carnival, Birmingham, Ala.
June 9.	Missouri State Model Airplane Contest sponsored by Missouri State Jr. Chamber of Commerce, Municipal Airport, Columbia.
June 9.	Annual Air Classic, Port Columbus, Columbus, O.
June 9–14.	SAE Summer Meeting, The Greenbrier, White Sulphur Springs, West Va.
June 9–23.	Annual Southwestern Soaring Contest, Wichita Falls, Tex.
June 15.	Official Opening, Municipal Airport, Philadelphia, Pa.
June 17–21.	American Society of Mechanical Engineers, semi-annual meeting, Milwaukee, Wis.
June 21.	Institute of the Aeronautical Sciences session at the Summer Meeting of the AAAS, Seattle, Wash. Presentation of Musick Trophy.
June 24–26.	Institute of the Aeronautical Sciences Annual Summer Meeting, Pasadena, Cal.
June 25.	National Inter - Collegiate Air Meet, L.I. Aviation Country Club, Hicksville, L.I., N.Y.
June 25–30.	Michigan Air Tour.
July 4– 6.	Air Show, Denver, Colo.
July 7.	Third Annual Air Races and Air Show, Kalamazoo, Mich.
July 7– 9.	National Air Congress and NAA Convention, Brown Palace Hotel, Denver, Colo.
July 21.	Fifth Annual Air Show, Fort Wayne, Ind.
Aug. 11–17.	Fourth Annual Air Tour, Wisconsin NAA.
Aug. 18–19.	Air Show sponsored by Sheldon NAA, Turner Field, Sheldon, Iowa.
Sept. 3– 6.	Fall Meeting, American Society of Mechanical Engineers, Spokane, Wash.

Spot Checking

President Roosevelt says his proposed huge expansion of airplane production should have federal financial assistance. RFC would be in the picture.

Auxiliary shadow plants would be built entirely by the government in cases where manufacturers didn't want to take loans or do their own financing. Each plant would receive individual financial consideration.

Though the Government may build plants and/or assist in financing them, it will in no case operate them, the President states.

Fifty-thousand U. S. warplanes would be almost equal to the air forces of all the belligerents combined. Passing you at 300 m.p.h., five planes per second, this force would make a parade 1000 miles long.

Allied purchasing mission announced orders for $350,000,000 worth of U. S. warplanes.

A bill was introduced in Congress to give the CAA Administrator control of the Washington airport property.

Air France Trans-Atlantique is authorized by CAA to start service this summer to the U. S. carrying French freight, mail, personnel, one round trip each three weeks.

Navy commissions a new air station at San Juan, Porto Rico as part of increased protection for Panama Canal.

Mechanic training programs will be sponsored by the War Department and by the aircraft industry. It is said that pilot physical standards will have to be let down (as they have been in other countries) to obtain the required cadets.

Don't overlook this point: the President asks that airplane production for the Allies be not interfered with. This means that France and England can have all of the new production they can pay for; if the Johnson law is repealed, all they can use.

Guy Vaughan, president of Curtiss-Wright, states that the industry, including his own company, is in an excellent position to undertake President Roosevelt's 50,000-plane program.

Stall and Spin Dep't.

Violations of civil air regulations were indicated in ten of sixteen fatal aircraft accidents analyzed by Air Safety Board during March, the Board announces. Accidents totaled 146, involved 153 aircraft, and 301 persons.

Of total accidents, violation of regulations was a factor in 23. Ten accidents involved fatalities, two serious injuries, and eleven minor or no injuries.

Spins and stalls caused sixteen fatalities. Low acrobatics caused one. Two fatalities involved persons walking into spinning propellers. A fatal collision was attributed to failure of each pilot to see and avoid the other during landing approach.

Heavy plane loading caused two fatal spills. Improper maintenance was found in one case the cause of a wing failure during acrobatics. In another, failure of fabric on fuselage was blamed for loss of control. Both resulted in fatalities.

Seven of the total accidents were the result of air or ground collisions, the board reports. Damage to aircraft destroyed 25 planes, severely damaged 157.

Of the 301 persons involved, 27 died, 15 were seriously hurt, 28 suffered minor injuries, and 231 escaped unhurt.

Congress at Denver

NAA's first national air congress at Denver, July 7–10 will begin operation under the new bylaws adopted at New Orleans in January. Executive committee, under new powers, is picking a slate of 21 directors to be ratified or replaced by congress delegates. Last three past-presidents will become ex-officio directors. New board is to represent all aviation angles. The congress will vote determination of new NAA policies, says Treasurer William P. Redding.

NAA took a vigorous stand on the CAA reorganization order. At its instigation, telegrams in protest poured in from chapters. A few favored the President's order. President Gill Robb Wilson put NAA's support behind opposition forces. Wilson's placing NAA on a definite side of the battle and securing civic support of this stand upped his chances to remain as NAA president after Denver, observers say.

Auto-Air—Another example of the trend towards combination of automotive and aircraft activity is seen in the acquisition by Hayes Manufacturing Corp. of the McCauley Steel Propellor Co. of Dayton. At the time Hayes reorganized, it announced it was going into the aviation field, but it continues the manufacture of auto bodies.

Air Race Trouble

Washington (AVIATION BUREAU)—Failure of Army and Navy to permit entrance of fighting craft in National Air Races this year appears to be main reason for Cleveland to skip 1940 classic. President Gill Robb Wilson of NAA doubts that there will be a show this year, "because current activity of both industry and the services makes it virtually impossible for them to participate."

Meanwhile, Newark withdraws its early bid through failure to raise $400,000 expenses, but New Orleans through its NAA chapter, makes a bid, following closely that of Birmingham whose National Air Carnival seeks wider recognition. Wilson, while admitting NAA has given New Orleans certain specifications to meet, says Air Races in future should cover all phases—flying parade of skycraft, exhibits, and demonstrations, as well as races. Emphasis should be on the educational side rather than on thrills, he asserts.

Cleveland, long the home of the Air Races, will exercise its franchise for the classic in 1941, Wilson says.

DENVER AIRPORT, where the aviation world will gather beginning July 7 to attend the National NAA Convention. With aviation affairs getting the national spotlight, this will be most important meeting in NAA history.

THE WASHINGTON WINDSOCK

by BLAINE STUBBLEFIELD

F. D. Roosevelt Will Fly It

Transfer to Commerce puts CAA back under Edward Noble, first chairman of CAA, now Under-Secretary of Commerce. Robert Hinckley, second chairman, was slated to be Assistant Secretary of Commerce, an office presumably inferior to Noble's present position. Noble wanted CAA transferred so he could run it. Hinckley wanted to *be* transferred so *he* could run it. It's reminiscent of the Vidal-Cone-Martin setup. Remember that? Anyway, F. D. Roosevelt can fly it from now on if he wants to. Of course Harry Hopkins is the Secretary of Commerce, but chances are he will not bother with the authority.

"The Most Naive Men In Town" is what a CAA gal called the Air Safety Board. "Why those fellows didn't even spend all their budget! And they're going to give it back to the treasury!" It's a fact. About 15 per cent of the 1940 appropriation of $380,000 will be turned back. Washington is not used to such goings on. It suspects that something must be wrong. Efforts were made to show the board at fault, but without any luck.

Automobiles Defend Airport. When the Swedes feared that the Nazis would occupy one of their airports they simply called for enough automobiles to scatter over it. A neat trick and anybody can do it. There are plenty of cars; they're mobile; they make landing impossible; afterward they're as good as ever.

Trans-Canada success stories tell all about the line's first birthday cakes, its 3,000-mile chain of airports hewn from the forests, and about Americans crossing the country that way for variety of scene. What most didn't tell is that P. G. Johnson, now back at his old stand as president of Boeing Aircraft, is still consultant to Trans-Canada, makes frequent inspection trips over the route, and is its guiding hand.

Airway lights are less useful as time goes on. Much night flying is now over the top. Pilots are on instruments a great deal even in the clear, night and day. Itinerant flyers without radio are on the ground at night, or had better be. Spacing of beacons has increased in recent years. But the friendly dot-dash has located more lost airliners than is recorded in pilots' reports. It may be lights out some sad day for old timers, but not yet awhile. Intermediate airline fields, too, are getting fewer and grassier, and the coyotes are seldom disturbed.

The trans-Atlantic low down, if you can take any more, is that if Italy enters the war, American Export's application (approved by examiner) might be held up for the duration. Certainly if granted it would be restricted to Portugal and Spain. The President might declare a combat zone around the entire Iberian Peninsula, which would rule out both Export and Pan American. In that case (I am informed by a man in the Willard Hotel bar) PAA would stop at the Azores, and Portugal, which is operated by the British, would shuttle out to meet the trips.

Railroads have been moaning for some time about competition from highway traffic, but its not often you hear that plaint from airlines. In Peru, however, where the plane has long been almost the only way of getting around, the government is beginning to put in roads, and air traffic has been dropping steadily since 1937. Express in particular has dropped nearly 25 per cent.

Yankee Conference

The New England Aviation Conference, sponsored by the six governors, was held May 17 and 18 under the Chairmanship of Harvey L. Williams, aviation executive and consulting engineer. The purpose of the conference was to co-ordinate the activities of aircraft and engine manufacturers with those of the manufacturers of parts and materials. Employment problems were considered and the promotion of air travel in the region was emphasized.

Destiny of Newark

Destiny of Newark airport seems pointed toward industrial trend with Brewster Aeronautical Corporation signing lease for municipal hangar and an option on 10 acres. Operations will not interfere with airline activity, say municipal officers.

D.C. Airport Opening

Ceremonies opening Washington airport are due for Labor Day with President Roosevelt attending. CAA plans to move in when its buildings are ready, but no definite time is set. Concessions are being considered to increase earnings.

No agency is yet designated to run the field. Federal government can't, because it has no precedent; that eliminates even CAA. Only possible operator agency remaining is the District of Columbia. As a combined municipality, county and state, D.C. could do it.

Shell Scholarships

Shell Aviation Scholarships this year go to the three outstanding U.S. student pilots. Seven regional contest winners compete for three Shell aviation scholarship awards at Washington after July 15. Student's record in CAA training program, his ability to execute specified maneuvers, and general aptitude govern his chances. First place gets $1,000 for continued aero studies; second place, $750, and third, $500, for same kind of study.

Photographing Farmers

Agricultural Adjustment Administration awards contracts totaling $200,704 for aerial photography of 102,800 square miles in sixteen states. New techniques in aerial photography, says the AAA, make possible more satisfactory pictures, and is reason for this work which includes re-photography of many sections. AAA says aerial photography is most economical and accurate method of determining performance on farms under crop control.

Calling Names

Jackie Cochran, aviatrix, sets record of 293 m.p.h. for a 100 km. speed course over New Mexico, bettering Roscoe Turner's record for 100 kilos by 3 m.p.h. Jackie will get a newly created William J. McGough Memorial trophy of N.Y.C. Service Post 501, oldest American Legion flying unit.

TWA's personnel changes include promotion of **John H. Clemson** regional traffic manager at Pittsburgh and New York to post of system traffic manager at Kansas City; **E. O. Cocke's** transfer from Los Angeles to district managership at Pittsburgh; new district traffic managerships in new offices for **J. Chesley Stewart** at Cincinnati, **Byron Skillin**, Boston, **J. J. Hollywood** at Harrisburg, Pa., and **W. H. Pluchel** at Fort Wayne, Ind.

J. J. O'Donovan, PCA's traffic vice-president is new administrative vice-president; **Luther Harris**, maintenance superintendent, heads his department with a new vice-presidency; and **J. H. Carmichael**, operations manager, becomes vice-president of operations. **Robert J. Wilson**, Grand Rapids, Mich. attorney, becomes a new Penn-Central director.

Edgar N. Gott, Consolidated Aircraft's vice-president married Miss Madie Koenig, Los Angeles, Calif. Ceremony held May 2 at home of **John H. Jouett**, president, Aeronautical Chamber of Commerce, in Washington. Best man was **Maj. Gen. H. H. Arnold**, Army Air Corps chief.

Evans K. Smith, air traffic school director and seller of first air ticket out of New York for passenger route, celebrates twelve years in the business.

James J. Fauteux heads Northwest Airlines' new agency in Chicago, developing air travel business through travel agents. **Remy H. Ludwig** becomes new Chicago sales representative for NWA.

Lawrence F. Zygmunt, Jr., Chicago, student at University of Detroit, is new president of National Intercollegiate Flying Club.

Aero Club of Washington is host to National Aviation Forum guests with **Capt. Corley P. McDarment**, president, in charge of "Dinner Aloft", banquet closing the four-day Forum.

W. Wallace Kellett, president of Republic, will vacation his entire 1,700 employees simultaneously, Aug. 24 to Sept. 3.

Shreve M. Archer, president of Archer-Daniels-Midland, is elected chairman of the board of Northwest Airlines.

Albert Edward Floan is appointed Seattle traffic manager of Northwest Airlines.

F. F. Bettiger, former factory super for Vought-Sikorsky, is placed in charge of all plant operations of Kellett Autogiro Corp.

Walter T. Varney, pioneer airline operator, has been added to the staff of the Market Research Department of the Lockheed Aircraft Corp., Burbank.

F. M. Hoefler has been appointed superintendent of production of the Harrill Aircraft Die Casting Corp.

Clyde S. Fullerton has been named Los Angeles district traffic manager for Transcontinental & Western Air, Inc., to succeed **E. O. Cocke**, who has been transferred to Pittsburgh.

Dr. Sverre Pettersen, meteorological professor at M.I.T. will deliver the 1940 Wright Brothers Lecture, Dec. 17, anniversary of the flight at Kitty Hawk. Pettersen was chosen by committee of Americans who have delivered Wilbur Wright Memorial Lecture before England's Royal Aeronautical Society.

Moye W. Stephens, assistant secretary, has been appointed to the board of directors of Northrop Aircraft, Inc. Stephens has been associated with the company since its inception.

DEFENSE

President Asks Billion for Defense
Calls for 50,000 Army, Navy Planes

Stark realities of German triumps in Europe and fear of American involvement in the war overseas stimulated a minor panic in the government this month and led the President to recommend to Congress a huge expansion and acceleration of our national defense program.

Following a series of conferences among the Secretaries of War, Navy and Treasury, the Director of the Budget and top-ranking military and naval officials, Mr. Roosevelt delivered a message to Congress asking that a billion defense dollars be made immediately available, bulk of it for the Army. He startled the country by saying we should have an airplane production capacity of 50,000 a year, and an Army and Navy air force totaling 50,000.

Committees began work at once on additional authorizing legislation while the House appropriations committee made plans to provide whatever funds could be released at once without additional supporting authority.

The Naval expansion program is expected at this writing to go through with dispatch, including a lift in aircraft authorization from 3000 to 4500 planes and increases in the number of Navy blimps to 18 to augment the neutrality patrol. Already approved by the Senate Naval Affairs Committee, it is thought probable that the funds to begin this expansion will be provided before adjournment.

The President asked for almost $200,000,000 to enlarge the Army's pilot training program for instruction of 7,000 flyers and to procure 500 additional aircraft, raising the total of Army planes delivered or to be ordered to the top limit of 6,000. The War Department had previously contracted for the original 5,500 under the first defense program.

20,000 Canadians

Canada starts its end of British Commonwealth air training program with enrollment of 169 students in military aviation course.

First step involves eight weeks of elementary flight training, followed by twelve weeks at observer schools, six weeks of bombing and gunnery instruction, and remainder of period devoted to training in fast fighters and bombers. First unit trains at Toronto. In three years, training scheme is ex-

NAVY WEATHER BOARD. Chief Radioman Harold A. Williams, looks over the new weather board he developed for the Naval Reserve Air Station at Floyd Bennett Field, Brooklyn. Board shows northeastern U. S. with an electric bulb at each airport. Navy pilots can tell from color of bulb what weather conditions are at all air fields.

S. A. GUIBERSON, president of the Guiberson Diesel Engine Co., and his son Allen, with their diesel installed in a Stinson Reliant. Performance of the engine is being carefully watched by Army officials at Bolling Field. Engine is a 310 hp., nine cylinder, air-cooled radial weighing 653 lb., for which is claimed great cruising efficiency.

pected to turn out 20,000 pilots, observers and gunners each year.

Air vs. Navy Again

Washington (AVIATION BUREAU)—Air power against sea power has changed from an academic question to a grim conflict for European supremacy. At last responsible authorities are speaking out on the subject.

The other day Navy Secretary Charles Edison came back from a trip with the fleet in its Pacific war games, called the press to his office, and calmly dropped a depth charge that went off and rattled the political dishes from coast to coast, including Mr. Edison's.

He simply said that airplanes have a temporary advantage over warships, and that he was going to recommend some changes in ship design. Concerning ships building and in service, he said that all objects on the topside that will splinter under bombing and destroy personnel should be put below or protected. The same treatment was recommended for fire and navigation controls on the deck. He said that crippling of these controls is a very serious matter. There are certain in-shore naval operations, within range of land air bases, that can no longer be undertaken at all, he said.

Regarding new construction, the Secretary made the startling statement that the topsides should be "basically" changed. Naval engineers assumed he meant to put steel armor turtlebacks on war ships. Edison said he didn't think battleships could be sunk by air bombs. But what he did say set a lot of minds in top political and militarist circles going in new directions.

Questioned about Edison's statement, the President told funny stories about how even the best authorities get excited when one war weapon takes the jump on another. They all fit together, he reasoned, and are always in a state of evolution. The warships will catch up all right, he said.

Within a day or two Secretary Edison, sounding as if he "didn't know it was loaded", modified his remarks; praised the Navy. Maybe he was taking himself to task; maybe the President did. But what he said in the first place is what he meant.

Meanwhile the authoritative British aviation magazine, *The Aeroplane*, says sooner or later bombing planes will prove superior to war ships. This opinion is grimly significant, with England staking her future on sea power.

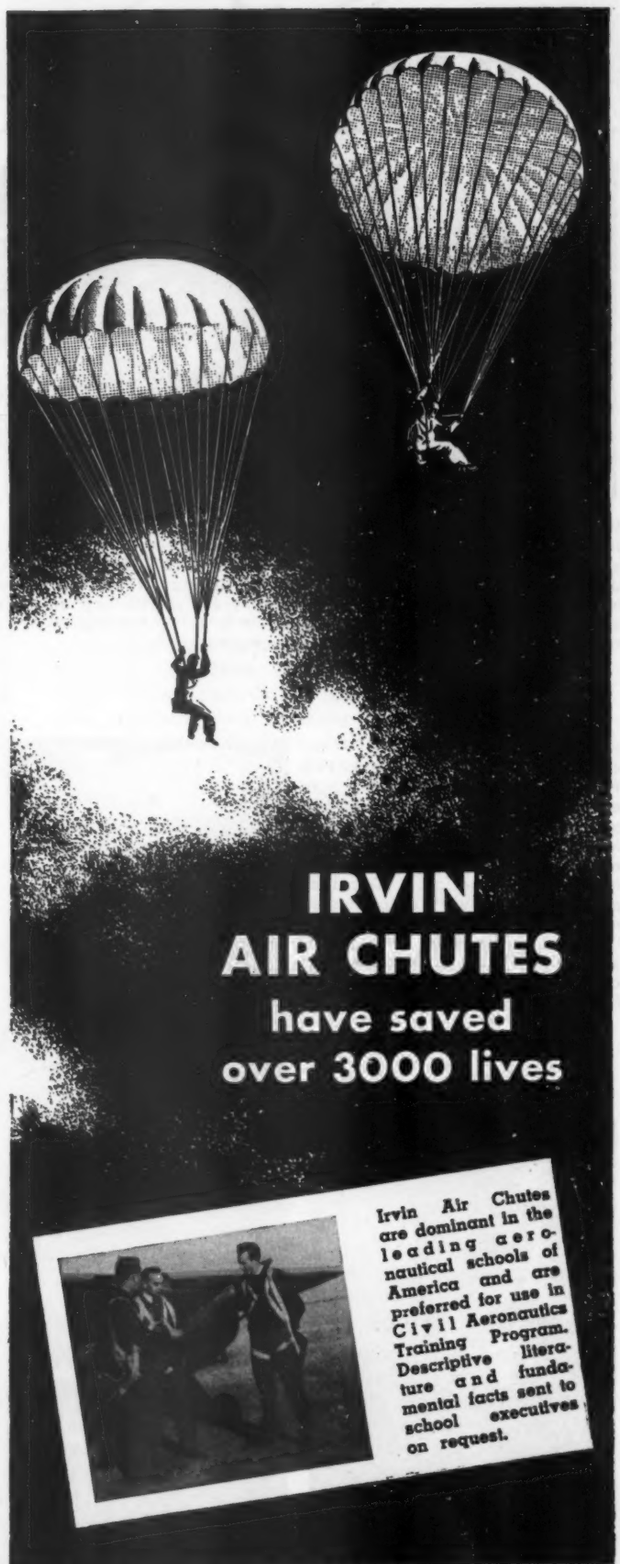
The firebrand boys say the air forces will blow navies out of the water. Moderates believe navies will need quick redesigning. Conservatives say that present fleets can take care of themselves. Take your choice.

Airplane Spotter

War Department engineers developed a new method for detecting the approach of planes, according to Col. L. B. Bender, Signal Corps. Details are secret but Col. Bender says "The device is successful in locating range of planes to efficiency of 2 or 3 per cent" and can determine their position in both vertical and horizontal angles.

Rocket Tests

An extensive rocket research program is being conducted at the California Institute of Technology under the direction of Dr. Theodore von Karman. Jet propulsion is being investigated.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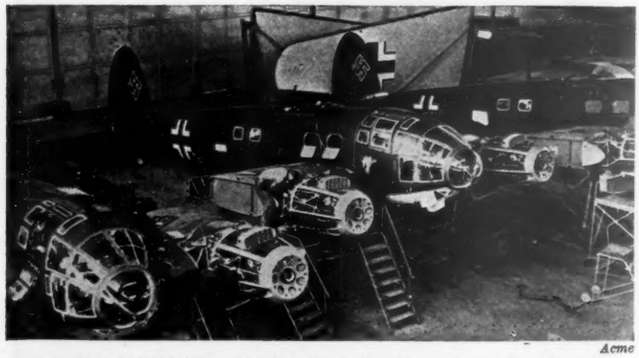
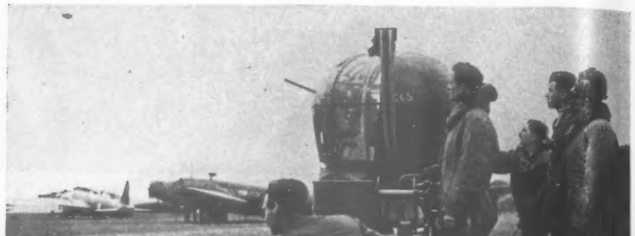


Acme

BUILDING HEINKEL 111 bombers in Germany. In her slashing attacks on the Allies, the Nazis have depended to a great extent on these bombers to clear a path for the mechanized units that follow. Exact output of German factories is not known but since total war began aircraft plants are on three shifts. Many women are employed in order to relieve men for the front. This view shows final assembly line.

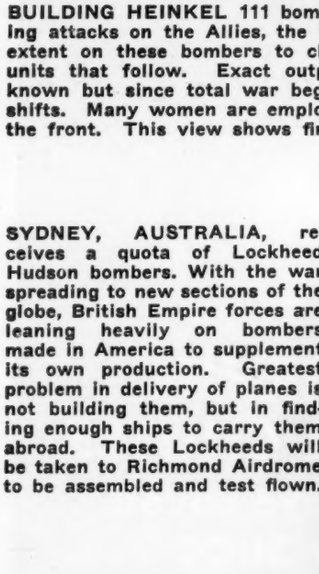


British Press Combine

TRAINING GUNNERS in the Royal Air Force at Central School in England. Students in gunner's turret fire a 12 gauge shotgun at clay pigeons. Gun is mounted to simulate conditions in actual flight and practice has proven of real value.

SYDNEY, AUSTRALIA, receives a quota of Lockheed Hudson bombers. With the war spreading to new sections of the globe, British Empire forces are leaning heavily on bombers made in America to supplement its own production. Greatest problem in delivery of planes is not building them, but in finding enough ships to carry them abroad. These Lockheeds will be taken to Richmond Airdrome to be assembled and test flown.

Allied Press Services



Keith Petrsch

JOE CROSSON, General Manager of Pan American's Pacific Alaskan Airways, who should get a great deal of the credit for the establishment of PAA's newest line, running from Seattle to Alaska, which has just begun regular operation.

International News

MILITARY AIRPORT AT ANDIR, near Bandoeng, Dutch East Indies. The USA Martin bomber in the foreground appears to be the most effective war plane on the field and the Dutch will count heavily on their Martins if trouble reaches the Indies. With Holland in the hands of the Germans there has been much speculation on what might happen to its wealthy and valuable possessions. Japan would like nothing better than to assume a protectorate" over the islands but has been sternly warned by U. S. State Department that we will not tolerate such goings on. Dutch East Indies has been a steady purchaser of American planes in recent years.

Canadian Aviation News

By James Montagnes

Major M. A. Seymour, St. Catherines, Ont., president of the Canadian Flying Clubs Association, has been awarded the McKee Trophy for 1939, Canada's highest aviation award, according to an announcement of the Department of National Defence on May 7. The award was made to Major Seymour "in recognition of the outstanding leadership he gave to the flying clubs of Canada in 1939. He elevated the flying clubs to a position where they could render a great service to Canada." Representatives of the Royal Canadian Air Force, the Department of Transport and the Flying Clubs Association made the selection from a list of individuals who had been submitted as possible candidates.

The McKee Trophy has been awarded annually since 1926 to the man who in the opinion of the judges, the Department of National Defence, has done the most to advance the cause of aviation in Canada. It was established by James Dalzéil McKee of Pittsburgh as a memento to the first trans-Canada seaplane flight made by Mr. McKee and a Royal Canadian Air Force officer in 1926.

Major Seymour, awarded the trophy, learned to fly in 1915 at Vancouver, served overseas with the Royal Flying Corps, and has been active in aviation since, and since 1924 has been a reserve squadron leader with the Royal Canadian Air Force. He was founder of the St. Catherines Flying Club, and has been its president the past eight years.

Trans-Canada Air Lines, publicly-owned transcontinental airway, plans to institute a thirteen-hour Vancouver-New York service by the spring of 1942, using the latest type Boeing stratoliners. With such a service the Canadian line is expected to provide stiff competition to present United States transcontinental services. The 33-passenger sealed cabin four-motored stratoliners are planned on because of the high altitude flying required at the western end of the trans-Canada route. Between Lethbridge, Alberta, and Vancouver, the Canadian Rockies tower 12,000 ft. and more, with the lowest pass, Crow's Nest, 11,000 ft. above sea level. During winter months planes have to operate above 12,000 ft., often go as high as 17,500 ft., to miss storms. At present oxygen masks are provided for passengers and crews for such high flying. The sealed cabin-type plane will eliminate this. Also the fact that Boeing president, Philip G. Johnson, put the Trans-Canada Air Lines on its operating feet, will be a factor in the choice of Boeing stratoliners, it is predicted in certain quarters. The use of these planes is expected to make possible flights straight across the Great Lakes, instead of at present circling the lakes to the north, thus eliminating some 350 miles from the transcontinental route. Favorable exchange due to the war will be expected to play a part in bringing United States transcontinental business to the Canadian line.

Canadian Associated Aircraft, Ltd., the assembly organization for war planes set up by six Canadian aircraft manufacturers, has started plant extensions at St. Hubert airport, Montreal, and Malton airport, Toronto, at a cost of $100,000 for each plant.

Fleet Aircraft Ltd., Fort Erie, Ont., decided at its annual meeting that without permission of the board of directors, no officer or employee shall be hired at a salary exceeding $3,000 per year and no pay increase above that figure shall be made. Employees and officers may now buy shares of the company at $10 a share, the number of shares so available not to exceed 9,711. The company is making training planes for the Royal Canadian Air Force.

An assembly plant for a large number of Avre Anson training planes is being built by the Department of Munitions and Supply on the property of the de Haviland Aircraft of Canada, at Toronto. The company is doing the assembly of the twin-engined training planes.

A revision to save time and money in the British Empire Commonwealth Air Training plan was announced at Ottawa, under which there will be four training commands, at Toronto, Winnipeg, Montreal, and Regina, as against the previously planned two training commands. Each of the four commands will be as nearly self-sufficient as possible. Twenty-four airports have been selected for military use directly or indirectly, and at or near ten of these airports training schools have been established under the training plan, according to the Department of Transport, Ottawa.

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PACKARD ELECTRIC DIVISION

General Motors Corporation

Warren, Ohio

AVIATION PEOPLE

Haley

NEW PRESIDENT of United Aircraft Corp. is its former senior vice-president, Eugene E. Wilson. Mr. Wilson has been with United since 1930, and has been in charge of many of the company's various manufacturing activities. He is a member of the Institute of the Aeronautical Sciences.

RAYCROFT WALSH, former general manager of Hamilton Standard Propellers division, succeeds E. E. Wilson as vice-president of United Aircraft. Resigning from the Air Corps in 1926, Major Walsh was associated with McGraw-Hill for two years, joining Hamilton Standard in 1930.

HARD WORKING Charles P. Graddick, superintendent of the division of air mail in the Post Office Department, joins United Air Lines as director of mail and express. During the 30 years he has served the Department, he has won the good will of his associates and the industry.

CLIFFORD J. LEISY has been named chief project engineer for Vega Airplane Co. In aviation since 1919 with Glenn L. Martin Co., Leisy rose to staff engineer; went with Great Lakes Aircraft as assistant chief engineer in 1929; joined Sikorsky in 1935; returned to Martin in 1937.

BARNUM Q. BAILEY of military aviation is Capt. Clarence S. Irvine of the Air Corps. He has just managed the 1940 National Aviation Forum's show at Bolling Field to complete success. Last February he staged an Army air show at Bolling for the benefit of Congress.

EX-NAVY PILOT Brian O. Sparks, has been appointed chief of the flight research department of Bell Aircraft Corp. Mr. Sparks has also piloted for Pan-American trans-oceanic services and was test pilot engineer for N.A.C.A. Bell has a Navy version of the Airacobra.

STEADHAM ACKER, director and impresario of Birmingham's Tenth Annual National Air Carnival, took many bows on June 1 and 2 for his fine showmanship in making the show its usual success. When not supervising this annual event, Acker efficiently manages Birmingham's Airport.

DYNAMIC BILL REDDING, Washington representative of the City of Denver and treasurer of the NAA, has been successful in bringing to Denver NAA's annual convention July 7 to 9. He plans for the first time to combine therewith an air show, staged by the ubiquitous Acker, July 4 to 6.

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● When this new Basic Trainer was designed, the engineers were required to draw up specifications for a safety factor of 10 instead of the usual 7.

This airplane, now in production, used Republic ENDURO* Stainless Steel for firewall construction — after finding by experiment and experience that it met fully the rigid requirements.

Airplane manufacturers today are using more and more Republic ENDURO Stainless Steel in a wide range of applications — exhaust stacks, collector rings, tail assemblies, instrument panels, pontoons and tanks. For each individual type of application there is a suitable ENDURO analysis — to resist corrosion or maintain strength at elevated temperatures — to withstand the unusually detrimental action of modern airplane fuels — to resist atmospheric or salt corrosion.

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AVIATION MANUFACTURING

Allies Take Option on 8000 U. S. Planes
More Than 4500 Have Been Delivered

Washington (AVIATION BUREAU)—Reason for all the confusion about what's in the Allied airplane orders is that the estimators, quite literally, don't know what they're talking about. Actually the order is something of a fiction; no contracts have yet been signed. What has happened is that preliminary agreements have been made, but just about as binding commitments have been made on a great many more airplanes. When Chairman Purvis of the Allied Purchasing Commission announces figures he could just as well use a larger or a smaller amount; more dollar figures will be announced at whenever seems to the Commission to be the most politically propitious moment.

Options, of varying degrees of firmness, have been taken on 5,200 bombers and 2,800 pursuit ships for delivery in the next eighteen months or so. The difference between the two types reflects the Allied weakness in long-range equipment which was so graphically revealed in Norway. Engines for the airplanes are being bought separately because the commission is having to pay the cost of the plants to build its orders. About 5,000 engines (3,600 of them Allisons) have been definitely lined up, and more are implicit in the plant construction agreements being worked out with Allison, Pratt & Whitney, and Curtiss-Wright.

Of the medium bombers, it is known that Lockheed will build about 700, and 4,250 will be divided between Martin and Douglas, each producing at a rate of about 150 per month. Martin will fill its entire order, but Douglas will probably subcontract some to Boeing and Consolidated.

Bulk of the pursuits will be furnished by Curtiss-Wright, which is to build 1,500 P-40s; this order will be switched over to the more advanced P-40D as soon as this model gets into production. About 800 P-38s will be bought, but Lockheed, busy with bomber manufacture, will probably subcontract this entire order to its Vega subsidiary and to Vultee. Bell will furnish 200 Airacobras (P-39), and where the remaining 300 will come from is uncertain; perhaps Republic or Vultee or possibly Bell.

Orders are about ready to be signed (this is roughly equivalent to the announced $200,000,000) on the Curtiss and Bell ships, on 250 of the Douglas bombers, and on the engines. Contracts will incorporate very favorable cancellation clauses, providing not only for all the manufacturer's out-of-pocket costs, including commitments to material suppliers, but also for the entire profit which the manufacturer would have made if the order had been completed.

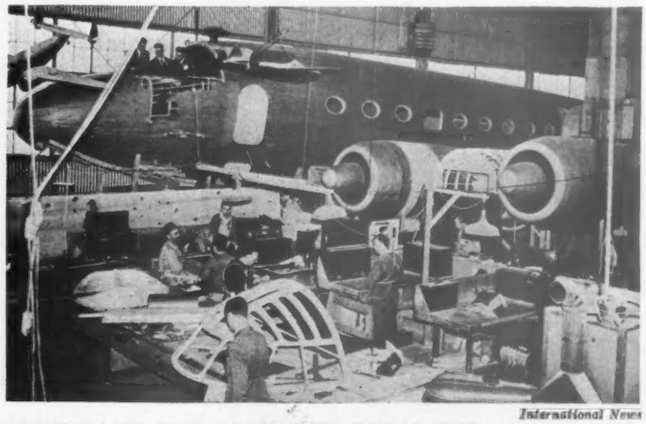
This new program of purchases followed the release for export of nearly all the latest type airplanes available here. These include Lockheed's P-38 two-motored interceptor and Hudson light bomber; Bell's Airacobra and Airacuda, single-engine and two-engine fighters respectively; Curtiss-Wright's P-40 single-engine pursuit and the improved version, the P-40D; two light Douglas and Martin attack bombers; and the big Consolidated four-engine bomber. Also released was the Grumman Skyrocket, a two-engine naval fighter for operation from carriers.

At the same time the Army deferred delivery on its orders for these types to give the Allies right of way. The arrangement is that when the Army does take delivery it will receive the latest models then available instead of the ships called for in its present contracts. The Allies will pay the cost of retooling and research for these hypothetical later models.

Before the new setup went into effect Allied orders since war started amounted to about 4,500 ships, costing something like $400,000,000. About 3,000 of these have already been delivered, according to Admiral Towers of the Navy Bureau of Aeronautics. This is rather higher than previous estimates. In any case it does not mean that 3,000 planes have been sent overseas. Actual shipments are still running around 200 per month, and the warehouses are filling up.

Nine on a Windmill

Nine aircraft companies on April 23 submitted bids at Wright Field on autogiros for observation work by the Air Corps. The bidders were George Francis Myers of Jackson Heights, N.Y.; Pitcairn; Pratt-Lapage Aircraft; Gerald C. Henney of Washington, D.C.; (on data and drawings only) Modern Aircraft, Inc., N.Y.; Russel H. Helligan, Beardstown, Ill.; United Aircraft (Vought-Sikorsky); Kellett Autogiro Corp.; and Central Aviation Corp., N.Y. It will take some weeks to evaluate the bids and make awards. Myers was the low bidder: $75,000 for one craft.



International News

MOCKUP OF THE LOCKHEED EXCALIBUR. In the midst of the great rush to deliver its war orders, Lockheed engineers are working on the Excalibur, a ship which will carry 30 passengers and a crew of six. The 74 ft. transport will be powered with four 1,300 hp. engines, will have a top speed of 300 m.p.h. and will cruise at 262 m.p.h.

B. G. Expands Again

The B.G. Corporation, New York City, manufacturer of aviation spark plugs, has again been forced to expand its plant. By taking over an additional floor comprising 13,500 sq.ft., manufacturing facilities at the 52d Street address, have been increased to 41,000 sq.ft. The additional space will provide expanded tool room, laboratory and engineering facilities.

New Light Plane

Designed to make a vigorous bid for a share of light plane business, a new 50-hp. two-place cabin plane of conventional design and construction has been test flown by the Interstate Aircraft & Engineering Corp., Los Angeles. The new Interstate plane weighs 1,150 lb. gross and will sell for less than $2,000. It is a high wing, strut braced monoplane seating two people side by side. The engine is heavily insulated with rubber cushioned mountings, and the landing gear incorporates advanced type hydraulic shock struts. Top speed is said to exceed 100 m.p.h. and cruising range is 3½ hr.

Recent Awards

War Department

Champion Spark Plug Co., Toledo, Ohio, $55,431 for spark plugs.

The BG Corp., New York City, $6,599 for spark plugs.

Aero Spark Plug Co., New York City, $44,251 for spark plugs.

Magnaflux Corp., Chicago, Ill., $70,568 for magnetic inspection apparatus.

United Aircraft Corp., East Hartford, Conn., $591,151 for maintenance parts for Pratt & Whitney aeronautical engines.

Navy Department

United Aircraft Corp., Stratford, Conn., $59,249 for spare parts for airplanes.

American Chain & Cable Co., Inc., York, Pa., $31,945 for fairleads, connecting chains, eyes.

Consolidated Aircraft Corp., San Diego, Calif., $26,221 for spare parts for airplanes.

National Fireworks, Inc., West Hanover, Mass., $21,322 for signals, miniature practice bombs.

Bendix Aviation Corp., South Bend, Ind., $15,630 for aircraft wheels, landing gears.

Curtiss Aeroplane Division, Buffalo, N. Y., $5,383 for spare parts for airplanes.

The U.S. Axle Co., Inc., Pottstown, Pa., $6,343 for stands and plates for aircraft engines.

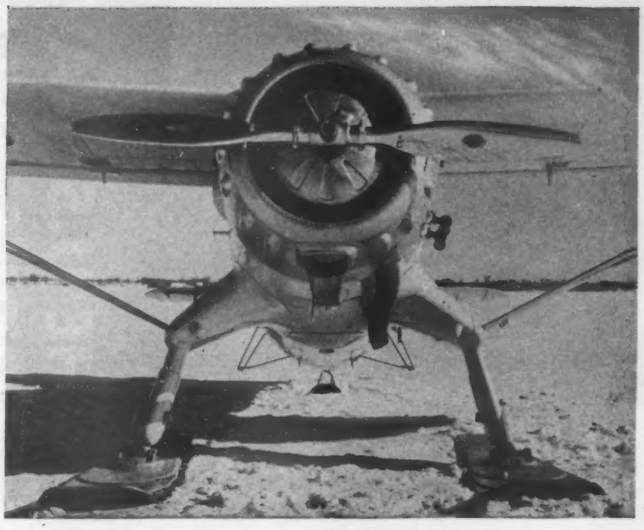
Western Gear Works, Seattle, Wash., $282,000 for machinery, boat and airplane crane.

Menasco Expands

Installation of $200,000 worth of new machinery by July 1 will greatly expand capacity of the Menasco Manufacturing Co. To meet current demand for engines for training planes the company is going to three-shift operation. Development work is under way on a new "V" type twelve-cylinder air-cooled engine to generate 770 hp., as well as on adaptation to this engine of the Unitwin drive now being used to couple two of the Menasco 300 hp. engines into a 600 hp. power unit. This development should make available power units of 1,500–3,000 hp. in the relatively near future.

Accessory Co. Merges

Creation of one of the largest aircraft accessory and parts manufacturing firms in the industry was disclosed recently with announcement by H. L. Brill, president of United Aircraft Products, Inc., of Dayton, Ohio, of arrangements for purchase of Aircraft Precision Products, Inc., of Los Angeles. Both companies have been engaged for some time in the manufacture of precision aircraft products, including valves, pumps, fuel systems, hydraulic actuating equipment, etc. Current combined backlog of the two firms is more than $2,000,000, and combined sales for the first quarter of the year totaled $672,729.40, resulting in a consolidated net profit of $123,774.64.



NOORDUYN NORSEMAN, new training plane being built in Montreal for British Empire Training Plan. Unique undercarriage can be fitted with wheels or skis. Ship has a 550 hp. P & W Wasp engine.

Pacific Aviation, Inc., Southern California's newest aircraft accessory manufacturer, commenced production late in May on a backlog of $50,000 worth of orders, according to a statement by Harry V. Reynolds, president. Pending completion of current financing the company has leased a small plant in Hawthorne, Calif., and has installed approximately $53,000 worth of production equipment.

The Dowty Equipment Corp. with a plant in Long Island City, N. Y., is manufacturing under license agreement from Aircraft Components Ltd., England, the Dowty "Liveline" hydraulic system and "Levered Suspension" landing gear. A E. Ulmann is president of the company.

Canadian plant: White Canadian Aircraft, which obtained a charter last March, has leased 31,000 sq.ft. of floor space and expects to get into production in about six months on a 2,243-lb. primary trainer.

Cubs: First quarter Piper Cub sales are 49 per cent ahead of last year. During 1939 Piper sold 1,806 airplanes; present backlog is over $1,225,000.

Gliders: Frankfort Sailplane Co., a new firm which has taken over the assets of a Frankfort, Mich., glider manufacturer, has leased space at the Howard Aircraft plant in Chicago and will turn out a line of single and two-place sailplanes, as well as operate soaring schools at Frankfort and Chicago.

"Ignition by Scintilla"
enhances an engine's efficiency
There's no denying the fact that aircraft engines are a modern miracle of mechanical efficiency. Equip them with ignition by Scintilla and their efficiency is enhanced and maintained—there's no denying that fact, either. For "Ignition by Scintilla" says safety, reliability, durability and all the other words that count for so much in aviation progress. The sheer excellence of Bendix-Scintilla Aircraft Ignition Equipment has earned its preferment by every branch of aviation—the Army, the Navy and every airline in America.
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BETHPAGE LONG ISLAND NEW YORK

AVIATION ENGINEERING

Stratosphere Research

To meet tomorrow's problems of stratosphere flying, Lockheed Aircraft Corp. is currently conducting extensive laboratory testing to supplement the pressure cabin information developed in connection with construction and operation of the Lockheed XC-35 Army altitude ship. Current tests are being made on a huge cylindrical shell, typical in size of the main portion of the fuselage of the new Lockheed Excalibur transport plane now being placed in production. This test section measures over 11 ft. in diameter and 20 ft. in length, and incorporates three different types of riveting. Test procedure consists of pumping up the cylinder to pressures as great as 865 lb. per sq.ft., and then applying external cantilever loads in order to observe the action of the structure, seams, rivets, etc. Moving pictures are taken showing behavior of the structure as it "breathes" under the application of internal pressure and wrinkles with application of external loads. Tests to date have been made on the simple cylinder, but shortly it is planned to cut windows and doors into the monocoque structure, corresponding to the windows, passenger and baggage doors of the completed plane, and then to study the action of the structure as well as of the windows, doors, and their sealing joints, under internal pressure and external load conditions.

No Army Diesels Yet

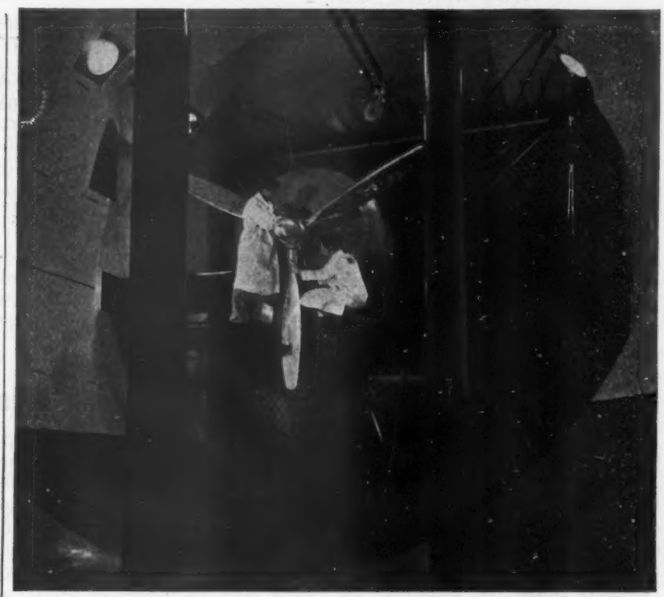
Washington: (AVIATION BUREAU) For the first time since the old Packard diesel was licensed ten years ago, an approved type certificate for aircraft has been awarded to a diesel engine—the Guiberson. The engine, now flying around experimentally in a Stinson, is a 310-hp. radial using the Lanova combustion system. S. A. Guiberson, a Dallas oil man who makes a $1,500,000 hobby of diesels, has arranged with Buda for its manufacture, and a $350,000 plant is being erected.

Secretary of War Woodring took considerable interest in Bolling Field tests of the engine, but stories that the Air Corps is going into diesels in a big way are decidedly exaggerated. Military interest in the Guiberson, in any case, is rather academic, since it is a small power plant suited to civil craft.

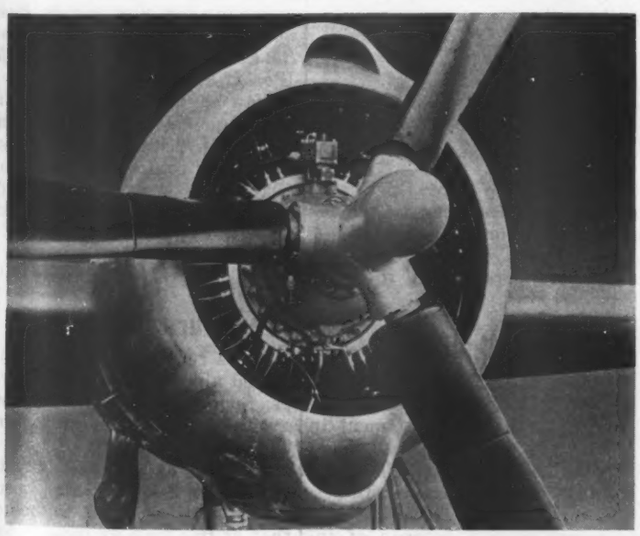
Eventual military value of diesels, as the range of bombers increases, is not ruled out however. Point is that although a diesel weighs more per horsepower than a gasoline engine and uses a slightly larger gallonage of fuel, diesel fuel weighs less per gallon than gasoline. Somewhere in the neighborhood of a 24-hour cruising range the total weight of fuel and engine becomes less for diesel power.

The 24-hour range is beyond the performance of present bombers, so no Army or Navy craft is now diesel-powered. The new 70-ton Douglas bomber, and the 85-ton ship Martin is supposed to be building for the Navy, perhaps exceed the critical range, but diesels were not even considered for them because no one now builds lightweight high-speed diesels in the upper horsepower brackets.

Looking forward to even bigger ships, however, the Navy Bureau of Aeronautics is now carrying on an ultra-secret program of research in cooperation with the Army Air Corps.



FOR PROPELLER TESTING Hamilton Standard have built themselves a new test house capable of testing propellers for engines up to 5,000 horse-power.



THIS ONE IS ON THE CUFF and is the result of a long test program by the Curtiss Propeller Co. to develop better cooling for cylinders. The results have also been reported to show increased take-off thrust and a reduction of blade shank drag at certain speeds. The cuff is fabricated from sheet aluminum alloy and can be removed for servicing. The Air Corps and the Navy now have many installations.

Bell Expands Research

Two new departments have been formed by Bell Aircraft to facilitate research and testing. A flight research department, headed by Brian O. Sparks, will do the company's test flying and also work closely with design and engineering. The new X-ray lab will test Bell's aluminum and steel castings and also do contract work for other firms; R. C. Woods is in charge.

Sikorsky Helicopter

On May 20 the first public test flight of the very hush-hush helicopter, designed at the Vought-Sikorsky plant, was made. This flight was the result of many years of work by Igor Sikorsky on the theory of vertical flight. The design of the ship was extremely radical and different from any thing seen previously here or abroad.

High Frequency

Federal Communications Commission announces temporary authorizations for use of radio frequency of 272 kc. for controlling aircraft at Los Angeles and Santa Monica, Calif., airports. Authorizations are good, pending decisions on applications by four airports to use ultra-high frequencies for aircraft control. FCC also granted Union Air Terminal, Burbank, and Long Beach Municipal airport continued use of 278 kc.

Commissioners recommended action because many of the skyports did not previously have radio control facilities, using light-signal gun for control.

TRANSPORT AVIATION

AE Line Recommended

After 3,000 pages of testimony, CAA examiner C. Edward Leasure recommended a certificate to American Export Airlines to operate between New York-Baltimore and Portugal, Spain, and Italy. The Authority will decide whether to issue certificate, could reject it, probably won't. Spread of the European war, especially if Italy enters, might hold up further action for the duration. Observers said even Pan American Atlantic service might be stopped by Presidential declaration of combat zone around South Europe, but political experts doubted this, because service is vital to the Allies. Meanwhile, United Aircraft's Sikorsky plant is building for Export three "express" liners modeled after Navy's "flying dreadnaught", to fly non-stop with sixteen passengers and crew of eleven to Lisbon in 16 hr. Examiner said a second Atlantic route is necessary in public interest, national defense, and to provide competition required by the law.

Air Mail Censors

PAA is still faced with Allied pressure to submit Clipper ships to search by both England and France. They allege possible contraband cargo in PAA's trans-Atlantic boats. France proposes joint Anglo-French air police to check trade in air contraband. French say Lisbon port collects $20,000 daily in customs duties, imply contraband air trade responsible.

President Juan Trippe, speaking to U. S. Chamber of Commerce at Washington, May 2, foresaw early start of PAA service to Australia on five-day schedule. In annual report, Trippe asserts "route certificates" assure continuity in Latin-American operations, justify "long-range planning". New land airports and new airway between Para and Rio de Janeiro are being constructed. Route mileage of PAA is now 63,305, compared to 53,548 miles in 1938.

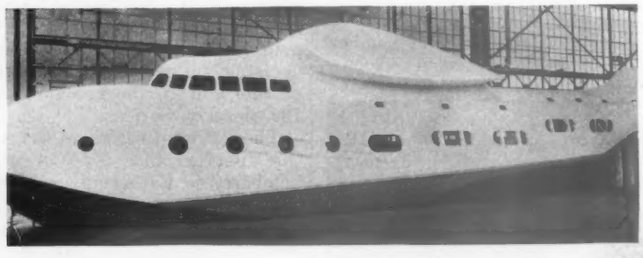
Instrument Landing Bids

CAA is taking a long step toward the day of routine zero-zero landings in receiving bids on blind landing equipment for installation at up to ten airfields. It is hoped that facilities will be installed by early next year, and an intensive program of pilot training and equipment testing can be started.

The ten new installations will be a fixed type similar to that installed for CAA at Indianapolis by the International Telephone Development Co. They will incorporate a two-course localizer, glide path, and inner and outer markers. One mobile system may also be bought for use in site selection.

It is possible that CAA may permit pilot training on the Bendix system available at Newark, Cleveland, Chicago, Oakland, and Burbank, and on the Air-Track installation at Pittsburgh.

THREE ADDITIONAL VICE-PRESIDENTS were elected to the staff of United Air Lines, from within the company's ranks. They are, left to right, R. E. Pfennig, in charge of the eastern division; S. V. Hall, in charge of the western division; and C. C. Thompson. J. A. Herlihy, operating vice-president for the past year, becomes executive vice-president in charge of operations, and P. M. Willcox, in addition to retaining the post of secretary, was named assistant to the president.



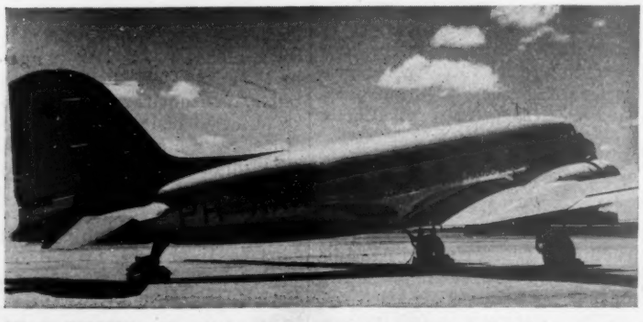
AMERICAN EXPORT AIRLINES is ordering three of these long-range ocean transports made by Vought-Sikorsky, of which this is a full-size mockup, as soon as it gets final CAA approval for its ocean route. The ships will have a cruising range of 5,500 miles when carrying sixteen passengers and a substantial mail and express load.

It Pays

Expansion of the joint advertising campaign of airlines affiliated with Air Transport Association begins with continuation of ATA's program, "It Pays to Fly." Erwin, Wasey & Co., agency, handles the campaign.

Col. Edgar S. Gorrell, ATA president, says general magazine list will include *Life, Saturday Evening Post, Collier's, Time,* and *Newsweek.* Business magazine list now covers *Business Week, Nation's Business, Sales Management, Traffic World, Editor and Publisher.*

New campaign will be run in full-page color and black and white copy, starting September first, and extending to June, 1941. Business paper copy starts during next few weeks, Gorrell announced.



KLM DOUGLAS which was bought by United Air Lines. Ship was being flown to New York for shipment abroad when war conditions prompted KLM to set the plane down in Chicago and sell it to United. KLM was less fortunate with the Douglases that were caught in Holland.

Manila to Indies

Philippine High Commissioner Francis B. Sayre makes suggestion to State Department in behalf of Philippine business, urging airline route between Manila and Dutch East Indies.

Proposal is revival of old project, shelved because of international complications with Japan. Nipponese, say Philippine interests, maintain they have equal rights with all nations in establishment of new airline routes in the East. Recent status of Japanese interest in Dutch possessions is causing heightened interest in revival of the project.

Express Reports Premature

Press reports that an airline-owned air express company will be formed to operate its own ground service are premature. The financial setup of such a company was outlined recently by Grover Loening, air consultant. Airlines seem to believe that at this time an independent pick-up-and-delivery service adequately covering the nation would not pay its way. Big question is whether rates could be reduced sufficiently to build profitable volume. Meanwhile, a CAA examiner in effect tabled the question by saying the Railway Express Agency, which now contracts with airlines for

air transit of express does not need the certificate for which it applied. The issue is left so it can be reopened, as it eventually will be.

Airline Doings

Addition of thirteen new flight schedules by five airlines using LaGuardia Field, with total schedules of 223 early in May, makes New York terminal the busiest in the world, it is claimed.

National Airlines applies for a route from New York to Havana, via Washington, Winston-Salem, N.C., and its present route from Jacksonville to Miami via St. Petersburg and Tampa. Line orders three Lockheed Lodestars and four four-motored Excaliburs in anticipation of certificate.

United Airlines doubles its recent contract for DC-4 Douglas Super-Mainliners by ordering twenty. Simultaneously, UAL orders ten additional DC-3's. Total expenditure will be $8,555,000.

UAL plans to enter Washington, filing for a route from Toledo to Washington, asserting it will not conflict with existing routes (PCA's Cleveland-Washington leg).

PCA receives last four of its new DC-3 Douglas "Capital Ships", places them on Washington-Norfolk route. Line starts non-stop Milwaukee-Detroit service over Lake Michigan. Flight is addition to existing schedules and takes 92 minutes.

AIR TRANSPORT INDICATOR

May 1, 1940

168.45

Which is the ratio of passenger-miles reported by the Air Transport Association for all domestic lines for April, 1940, to the figure for April, 1939. Total for the indicator has increased slightly over the last month and still remains far ahead of last year. For the first four months of 1940 traffic stood at 261,443,435, revenue passenger miles—up 66.0 per cent.

See Finance page for individual companies' traffic figures.

TWA files for a new route from New York to Boston, via New Haven and Worcester, Mass., joining UAL as possible competitors to American Airlines.

Braniff names new Texas-Mexico schedule, "Mexpress Flyer," in a cooperative service with PAA. Schedule originates at Amarillo, goes via Fort Worth, Dallas, Houston, Corpus Christi and Brownsville. Supplementary flight originates at Dallas, via Austin and San Antonio to Brownsville where connections are made with PAA's new non-stop Brownsville-Mexico City flight.

American Airlines inaugurates a 7 a.m., Washington-New York flight, believing that even politicians will get up early. Breakfast en route, says Herb Ford, DTM at Washington, will epicure them.

NWA passengers ride at night on a radio beam that plays swing music. New adaptation of ring antenna and radio compass lets pilots tune in commercial stations and fly radio compass arrow.

TWA takes delivery on first three four-motor Boeing "Stratoliners," for high-altitude flights. Line expects to inaugurate their service at early date. Jack Frye, president, announces TWA will seek new line from New York and Philadelphia into Atlantic City.

PCA also asks Atlantic City stop on route from Baltimore to Philadelphia and Newark.

Subsidies Evaluated

Public subsidies to civil air transportation amounted in 1936 to about $21,400,000, it is estimated in the massive report on public aids to transportation just completed under the supervision of ICC Chairman Eastman. In the same year subsidies to railroads totaled $35,600,000, to water transport $128,528,000, and highway traffic was unsubsidized.

The air subsidy is made up of $14,400,000 to scheduled airlines and $7,000,000 to unscheduled operations. The airline subsidy consisted of $8,200,000 by which airmail payments exceeded costs, $2,800,000 for public expenditure on airports, and $3,400,000 for airways and services. Charged to unscheduled flying is $4,200,000 for airports and $2,800,000 for airways and services.

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AVIATION FINANCE

New orders for warplanes push the unfilled backlog of the aircraft industry well over the billion dollar mark while record first quarter earnings foretell excellent earning power in store for the balance of 1940. Meanwhile airline traffic runs ahead of all past records.

Curtiss-Wright reported the largest first quarter earnings of any aviation company, profits of over $2,400,000 topping by a small margin United Aircraft's equally favorable report. The earnings table on this page shows all reporting companies at profit levels well above last year, the majority enjoying the best three months in their history.

Domestic air traffic set a new all-time high record in April for the second straight month. Revenue passenger-miles flown in April neared the 80,000,000 mark for the sixteen lines reporting to the Air Transport Association, as compared to 73,000,000 in March and 70,000,000 last October, the peak month in 1939. Collective air line earnings for the first four months of 1940 were close to $1,000,000, as compared with a $730,000 loss last year. Following is a tabulation of revenue passenger-miles flown by domestic airlines in the first four months of 1940 and 1939.

Revenue Passenger-Miles

	1940	1939
Jan.	55,234,672	34,457,270
Feb.	53,025,818	31,046,932
Mar.	73,096,779	44,441,846

Eastern Air Lines and Boeing Airplane sought new funds last month through common stock financing. Eastern offered stockholders 110,909 shares at $32 a share in the ratio of one-fourth share for each share of common held.

Boeing placed a subscription price of $16 a share on the offering of 360,979 new shares to stockholders, in the ratio of one share for each two held. Boeing deliveries during the March quarter amounted to $4,631,000, and unfilled orders April 1 totaled $18,794,000.

Pump Engineering Service Corp., aviation division of Borg Warner, is operating double a year ago and further increase in output is anticipated. Aircraft makers are reported to have asked the company if production could be tripled within seven months. Borg Warner's aim was stated to be to increase Pesco's production as much as possible without unnecessary expansion in plant capacity.

Douglas backlog of unfilled orders, official and unofficial, totaled over $120,000,000 last month, excluding the new order of upwards of $75,000,000 recently placed by the Allied Air Mission. About one-half of the current backlog is estimated to represent foreign military orders, 30 per cent commercial orders and U.S. military the remaining 20 per cent.

Abandonment of the proposed merger of Curtiss-Wright Corp. and Atlas Corp., under which the investment trust was to contribute up to $37,000,000 in new capital to the aircraft company, was announced on May 11. Objections by numerous stockholders indicated that the merger would not obtain the necessary two-thirds vote of approval and the plan was accordingly withdrawn.

While new Allied war orders will cause backlogs of several companies to show further gains of from $30,000,000 to $100,000,000 when officially added to current bookings, the following table gives the approximate unfilled orders of some of the leading aircraft manufacturers in the forepart of May:

Company	Backlog
Curtiss-Wright	$160,000,000
United Aircraft	155,000,000
Douglas	118,000,000
Lockheed	60,000,000
Boeing	25,000,000
Vultee	14,000,000
Republic	12,000,000

Financing program of Airplane Manufacturing & Supply Corp. was completed with oversubscription of an issue of 210,000 shares of $1 par value common stock. The offering provided financing for the purchase and consolidation of Pacific Airmotive Corp. and Airplanes Parts & Supplies, Inc., formerly divisions of Bendix Aviation, Ltd.

Solar Aircraft, which is riding the wave of booming military business, recently set an all-time high for a 30-day period by shipping $133,000 worth of manifolds and airplane parts during the month ended April 27. Shipments have been averaging in excess of $100,000 per month.

Fletcher Aviation Corp. has been formed at Los Angeles, with authorized capitalization of $2,000,000. Directors of the company are Wendell and Maurice Fletcher, of Burbank, and Frank P. Fletcher of Santa Monica. It is the plan of this new company to manufacture cabin type private aircraft powered with a radial type air cooled engine built by the same firm.

Lockheed Aircraft, consummating its largest commercial deal of recent months, has signed contracts with South African Airways covering a $2,100,000 order for a fleet of thirteen Lodestar type; 14 passenger transports, and two of the new 44-passenger four-engine Excalibur transports.

Here And There . . . *Piper Aircraft* has unfilled orders for over 1,000 Cub planes while production has recently been at the rate of 55 planes a week . . . Financing of *Aeronautical Corp. of America* has been completed by Whitney-Phoenix Co. through the sale of 63,000 shares of common stock at $6.25 a share . . . *Lockheed* has sold over 50 Lodestars, introduced six months ago . . . *Aero Supply* first half earnings are likely to exceed those for the full year 1939 and directors are considering a mid-year dividend on the Class B stock.

Current Earnings Reports

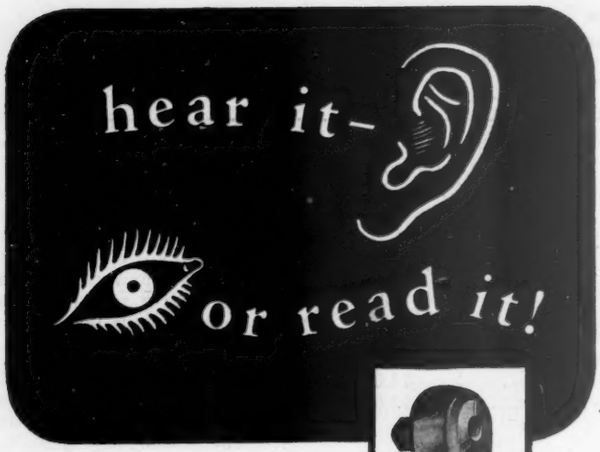
Company	Period	Net Earnings 1940	Net Earnings 1939	Common Share Earnings 1940	Common Share Earnings 1939	Sales 1940	Sales 1939	Backlog 1940	Backlog 1939
Aero Supply	Qtr. Mar. 31	$115,235	$16,768	$0.26	$0.03	.....	.....	.....	.....
Air Associates	6 Mos. Mar. 31	123,593	16,953	1.14	0.07	.....	.....	.....	.....
American Airlines	Qtr. Mar. 31	304,053	23,801	0.86	0.08	$3,862,157	$2,609,199	.....	.....
Aviation Corp	Qtr. Feb. 29	d 196,447	d 426,280	....	....	.....	.....	$4,131,000	$3,507,000
Borg Warner	Qtr. Mar. 31	1,776,240	1,154,705	0.76	0.50	.....	.....	.....	.....
Curtiss-Wright	Qtr. Mar. 31	2,414,196	1,698,156	0.24	0.15	.....	.....	.....	.....
Douglas	Qtr. Feb. 29	1,804,877	771,522	3.00	1.35	12,920,904	6,408,020	113,000,000	33,000,000
Eastern Air	Qtr. Mar. 31	511,578	233,125	1.17	0.56	2,828,800	1,924,200	.....	.....
Eaton Mfg	Qtr. Mar. 31	937,878	725,999	1.33	1.03	.....	.....	.....	.....
Ex-Cell-O Co	Qtr. Mar. 31	577,495	149,771	1.45	0.38	.....	.....	.....	.....
Fairchild Av	Qtr. Mar. 31	209,012	56,254	0.62	0.16	.....	.....	1,960,505	1,113,284
Square D Co	Qtr. Mar. 31	400,858	120,600	0.89	0.35	.....	.....	.....	.....
Thompson Products	Qtr. Mar. 31	522,168	325,156	1.65	1.07	5,486,370	3,598,666	.....	.....
T.W.A.	Qtr. Mar. 31	d 391,458	d 364,841	....	....	1,777,041	1,311,880	.....	.....
United Aircraft	Qtr. Mar. 31	2,380,029	1,490,799	0.89	0.56	16,666,000	9,786,300	126,337,000	127,004,000

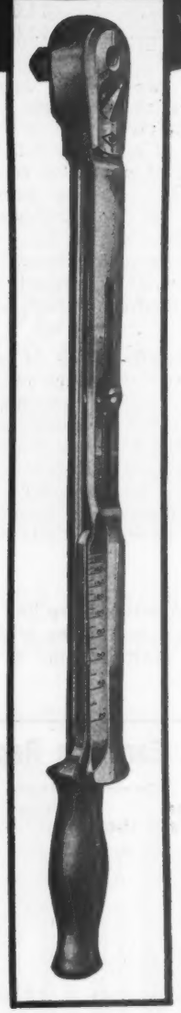
* estimate. d—deficit

With the Airlines

Company	Revenue Passenger Miles* April 1940	April 1939	% Gain	4 Months 1940	4 Months 1939	% Gain	Revenue Passengers April 1940	April 1939	% Gain	4 Months 1940	4 Months 1939	% Gain
American	23,887	14,031	70	78,034	45,941	70	64,876	35,709	81	204,392	111,830	83
Braniff	3,218	1,450	122	9,307	5,199	88	9,612	4,608	109	29,857	16,525	80
Chicago & Southern	1,033	750	37	3,193	2,193	45	2,554	1,897	34	7,947	5,401	47
Eastern	13,455	8,401	61	54,455	34,725	56	27,254	18,156	52	98,854	65,581	51
Northwest	.....	.....	.....	b 7,501	3,592	108	.....	.....	.....	b 18,759	8,766	114
Penna Central	2,866	1,633	76	8,505	5,061	60	16,166	9,120	77	47,166	28,320	66
T.W.A.	.....	.....	.....	b 22,330	13,763	62	.....	.....	.....	a 27,894	14,981	86
United	16,064	10,057	60	48,487	30,500	60	.....	.....	.....	a 38,161	23,353	65
Western Air	.....	.....	.....	b 2,558	1,552	64	.....	.....	.....	a 4,305	2,609	65

* (000 omitted). a — 2 months b — 3 months — current figures subject to final adjustment.





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Aircraft Stocks In War Markets

By Raymond Hoadley

Mr. Hoadley will be pleased to answer inquiries regarding the financial outlook of listed aviation companies

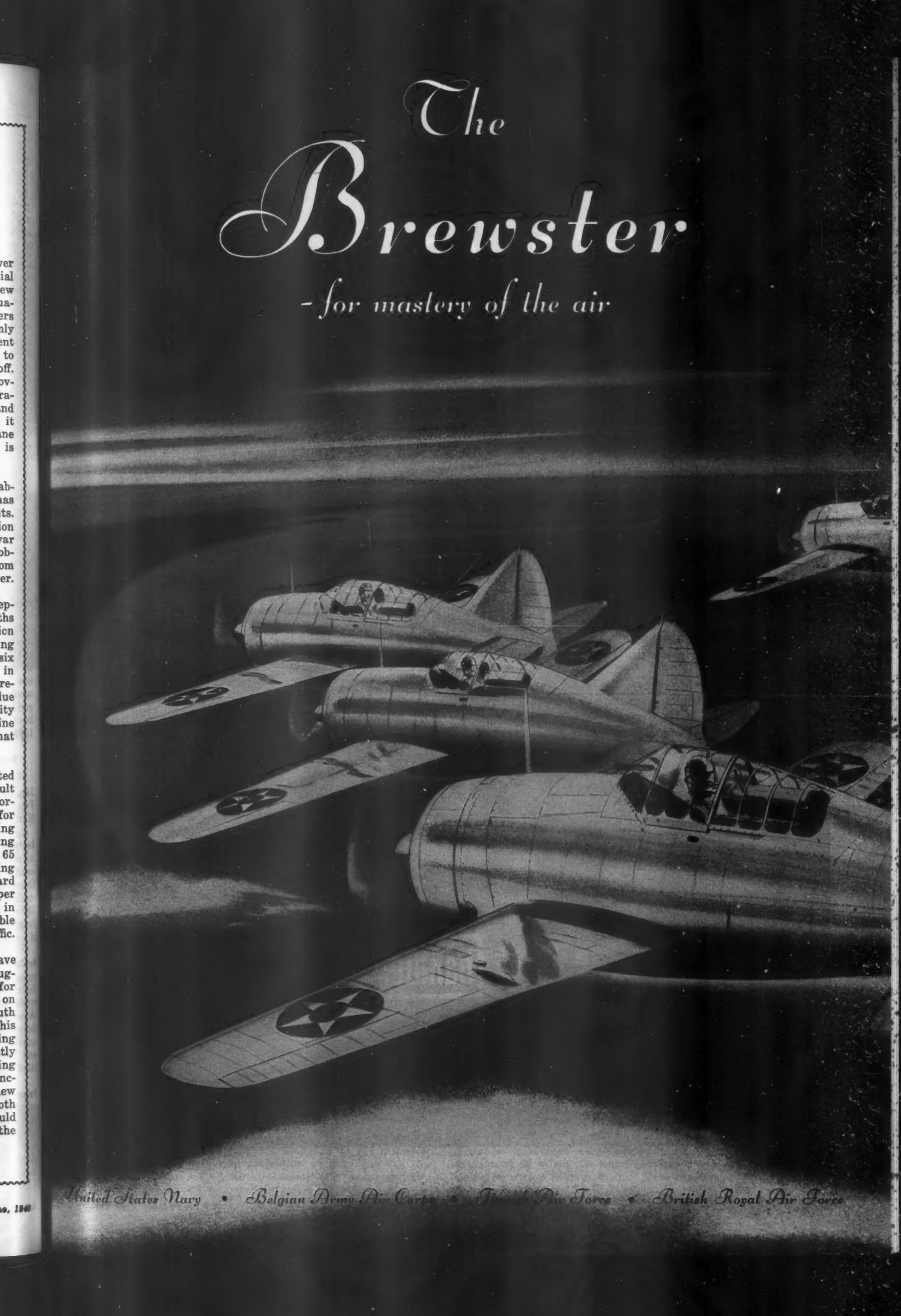
Despite the war boom, aircraft stocks have sold at a lower price this spring in relation to unfilled orders and potential earning power than any other group listed on the New York Stock Exchange. Dependent, of course, on continuation of the war over the next fifteen months (some orders for warplanes run that long) they represent the only industry we know of that is definitely assured of excellent earning power well into 1941. New business continues to come in more rapidly than old orders are worked off. Military orders from the United States and foreign governments should keep many companies at capacity operations for the balance of the big fight while commercial and private plane sales keep pace proportionately. And it might be noted here that commercial and private plane sales will increase at an even faster rate when peace is declared.

Some aircraft stocks have been selling below the high established in 1935–38 although the expansion since then has been several-fold in plant, employment, sales and profits. On the other hand airline stocks sell fairly high in relation to current earnings, although they lack the speculative war flavor attached to the aircraft issues. The answer probably is that in wartime the so-called war babies seldom sell on a basis that fully discounts increased earning power.

Earnings of the aircraft companies, almost without exception, will be at new record levels for the first six months of 1940. It is becoming almost commonplace to mention increased profits for this group but the fact is—barring production or labor difficulties—earnings in the next six months and again in the forepart of 1941 will continue in an upward curve. And the machine tool makers are presenting a forestaste now of the prosperity that is due shortly in the aircraft industry. Operating at capacity with huge orders on the books, earnings of the machine tool companies reflect the vast amount of tooling up that is under way in aircraft factories.

It now looks as if airline travel this summer will be limited only by the amount of equipment available. As a result of the traffic gains experienced last year the airlines ordered upwards of 50 transport planes in preparation for the 1940 peak season. Now airline officials are regretting that they did not order still more equipment for late spring delivery. Passenger air traffic in the first quarter was 65 per cent higher than a year ago. In view of this showing estimates of the full year's gain have been revised upward to between 40 per cent and 50 per cent from the 30 per cent forecast of a few months ago. A serious recession in general business or a bad accident appear the only possible obstacles to another year of amazing growth in air traffic.

United Air Lines and Eastern Air Lines within the month have purchased more than $6,000,000 worth of additional Douglas equipment. United's order includes ten more DC-4s for delivery in 1942, indicating that this line is figuring on steady traffic gains well into the future. Incidentally South Africa Airways, in purchasing 29 Lockheed Lodestars this spring, must be optimistic on the outlook too. Providing the facilities to meet such rapid traffic expansion is costly business, and United as well as Eastern may be seeking new funds in the capital markets. And speaking of financing, Bell Aircraft may soon join Boeing in seeking new working capital through the sale of additional stock. Both companies have large backlogs of new contracts that should allow them to show sharp gains in earning power over the indifferent results obtained in 1939.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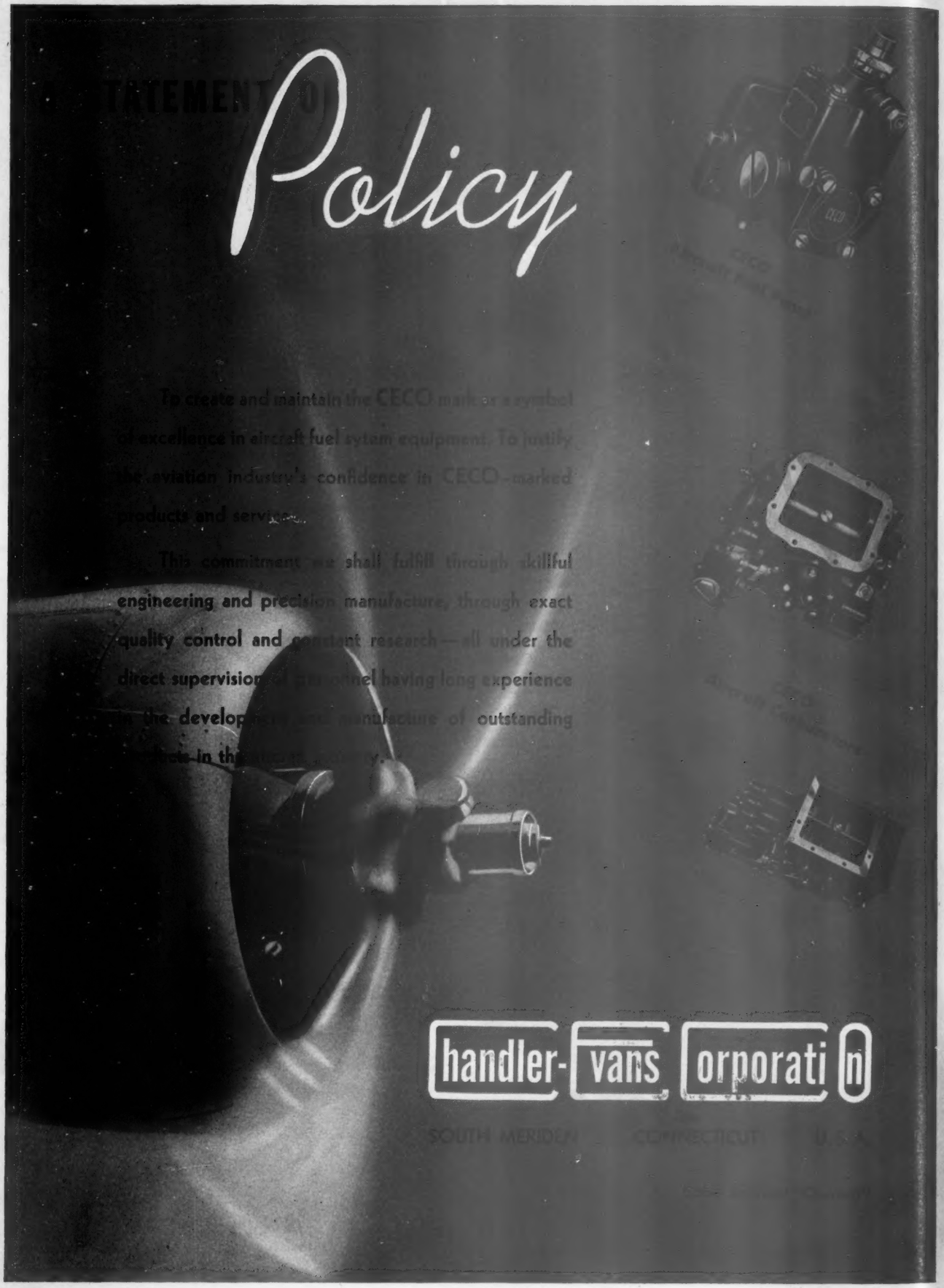
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AVIATION OPERATORS CORNER

Beaverton Airport

Anyone interested in aviation who has traveled through the Northwest has heard of Beaverton Airport, which is located 10 miles outside of Portland, Ore. The boys who fly there claim it is the largest amateur airport in the United States. While the general policy in vogue at Beaverton is not one that we can approve of, the field contains so much of interest that we pass this information on to our readers. The field contains about 29 hangars and 41 airplanes. The unique feature of this airport is that only one of the airplanes is registered by the Civil Aeronautics Authority. The great bulk of these airplanes are home-made. As a general rule, backyard designers kill themselves pretty promptly, but Beaverton seems to be the exception. In ten years filled with flying activity, there have been only two fatal accidents to flyers who use this field as a base, and neither was due to the fact that the airplanes were of the home-made variety.

The field is owned and managed by Charles Bernard, a native of Oregon, who has been interested in aviation for years and who felt that something should be done for the young men of his section who could not afford to buy airplanes.

The pilots either build planes from the ground up, or they buy old jaloppies and fix them up until they are passed on by the state inspector. Most of the builders have been intensely interested in aviation for several years and some have studied design and construction for as much as five years before they start to build their own ships. Until last November a state inspector did all of the inspection work but at that time the number of aircraft subject to inspection became so low that the state board discontinued the position of inspector and appointed a director of aeronautics to care for the inspection work. At present the actual inspection is done by two licensed mechanics or by one licensed mechanic and an aircraft repair shop which is recognized by the state board.

Until recently the state registered aircraft, and pilots were not "molested" by CAA inspectors. However, at the present time there is a charge pending against two pilots operating from the Beaverton airport for violating Civil Air Regulations. It is claimed that they flew a ship which was not certified by CAA on a Civil Airway. The Beaverton airport is located on a Civil Airway and the present charge of violation may have a far-reaching effect in determining whether CAA can appropriate the air space over any state and prohibit the use of such space to private aircraft not engaged in interstate traffic. If the CAA is successful in its suit, activities at Beaverton may be brought to a complete stop.

It is interesting to note that one of the Beaverton boys is George Yates, who has perfected the wood basket-weave construction in his wings, and fuselage.

About the time this reaches you, the tenth annual Birmingham National Air Carnival will be taking place. Director Steadham Acker tells us that this will be biggest and best in the long series of successful carnivals. Last year more than 300,000 spectators came to Birmingham and this year they expect even more. Thrilling aerial stunts, spectacular exhibitions and a glamorous beauty pageant are only a few of the great things in store for visitors there.

In conjunction with the big carnival, an air tour will be held to Birmingham in which the Gulf Oil Co. will give free gas and oil to all participants. This should bring a great many light planes out for the meeting. For all who cannot attend we promise to print a picture in our next issue of the winner of the beauty show.

The State of Rhode Island has a new special agent on aviation connected with the Rhode Island Industrial Commission. Recently Governor William H. Vanderbilt appointed Henry E. Cockrell to this post. Mr. Cockrell has been in aviation work since 1910. He is now making a wide survey of the aircraft industry in the hope that he can re-establish some of its activities in Rhode Island.

The Bellanca Cruisair will make sales for you without a demonstration, according to E. W. Wiggins of East Boston. Wiggins is a Bellanca distributor and he had his Cruisair on the line in front of his hangar for only a short time when Mr. Howell F. Shepard, president of the Watson-Park Co. of Boston, saw the ship and immediately wanted to buy one. Mr. Shepard is not a pilot and he is now learning to fly his new airplane.

The old Cannon Mills airport at Orlando, Fla., has been purchased by the Florida Aeronautical & Supply Co., a new firm headed by Walter Castle, Short Hills, N.J., and Howard Pike, Goshen, N.H., both aeronautical engineers. Purchase price is reported as $12,000. In addition to operating a flying school and plane rental service, the two men will establish a complete repair and overhaul shed, specializing in light planes, and act as Aeronca agents for the Orlando area.

Hibernating Cub

If some of you operators think you had a tough time with ice and snow last winter, listen to this one. W. B. St. John, sales manager for Piper, gets credit for this story of Alaskan flying. A government official whose job it is to watch smuggling along the Canadian Alaskan border, flies a Cub. He goes zooming along the border until he locates an area where smuggling seems to be in progress. Then he lands his ship, stakes down the Cub and—here's where the originality comes in—he gets out a 30-ft. jointed pole and fastens a red flag on the top of it. He sticks the flagpole into the snow, puts on his snowshoes and goes out

"Three Lions"

General view of the Beaverton airport. Hangars on the left look small, but each has a narrower projection at the back for the ship's tail. Field is on a CAA airway, which may cause trouble.

"Three Lions"

This is a midget single-seater built by Walter Rupert. It cruises at 85 miles per hour and has a top speed of 140. It is powered with a French motor. Note the Oregon license number.

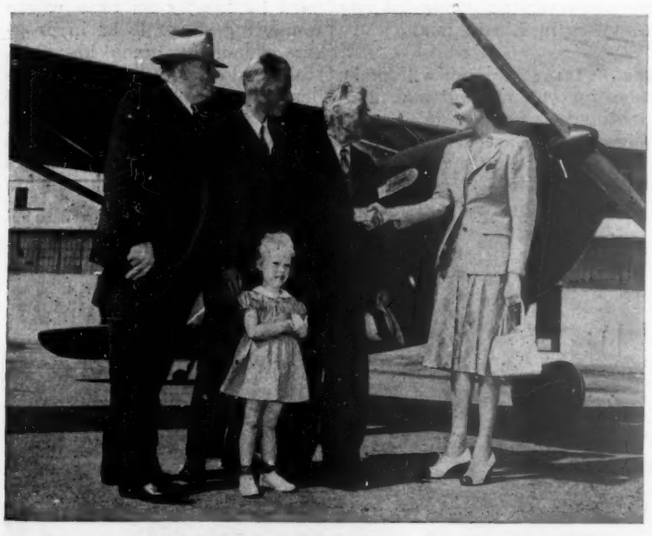
to investigate. He may not return to his airplane for several days and when blizzards are raging the red flag is often the only indication of the location of his airplane. When he sees the red flag he makes camp, digs the Cub out of the snow, and takes off. Since hearing that story, we have often wondered why the smugglers don't sneak up on the ship and move the flag somewhere else.

TRAINING

Aviation schools will be interested in a new phonograph record recently put out by General Records. It is No. 6001 and is called "The Flight of the Flagship." It is a story of a coast-to-coast trip on an American Douglas and contains actual recording of the sounds from beginning to end. The record opens with a tremendous roaring of engines and then a dispatcher calls the flight, the stewardess greets her passengers, and the trip is on. Part of the record has been made in the cockpit of a Flagship and radio signals come through with great clearness. The record should be interesting as well as instructive for students interested in airline work. Capt. William Lester, chief of American Airlines' Pilot Training School, gives a short explanation of how the radio beam operates.

Students from 382 colleges of those taking part in the civilian pilot training program have indicated their intention of participating in the national Shell Aviation Scholarships and awards, it was recently announced by Major Lester D. Gardner, of the Institute of the Aeronautical Sciences, who is managing the competition. The three outstanding student pilots of the country will be selected about July 15 by means of an audit of their class grades and by a nation-wide flight competition. Seven regional elimination contests are to be held, after which the seven winners will compete for the three national scholarship awards at Washington, D. C., this summer.

Here is a new way to reward your students after they solo. Down in Miami the Embry-Riddle Flying School has been teaching a unit of the civilian pilot training program to fly on floats. Recently when the first three students soloed crisp 18-in. paper wings were hung across their chests. Then the trio was dumped into a swimming pool. Following the "dunking" the boys were publicly embraced by their girl friends and then Miss Ruth Shelley, whose picture you saw as Miss Aviation of 1940, was on hand to contribute what the reporters said was a queenly kiss. Whether or not Miss Aviation would fly up to your field for your graduation exercises remains to be seen.



FOUR GENERATIONS GO ALOFT. AVIATION'S Western Editor, Charlie McReynolds, decided to celebrate some family birthdays by taking the air-minded McReynolds for a flight in a Stinson 105. With his father, grandfather and daughter, Charlie made a carefree flight over Southern California, establishing a new high in four-generation flying. Gladys O'Donnell, right, noted woman pilot who is committee chairman for California's Aviation Ball on May 25, congratulates 90 year old Aaron McReynolds, one of the State's pioneer settlers. Col. Frank R. McReynolds, left, and Charlie look on with approval.

JERRY SAYS

By JEROME LEDERER

Vertical Envelopment: 1783. One hundred and fifty-seven years ago, Benjamin Franklin wrote about aviation to a friend. He said, "It appears, as you observe, to be a discovery of great importance and what may possibly give a new turn to human affairs. Convincing sovereigns of the folly of war, may perhaps be one effect of it since it will be impossible for the most potent of them to guard his dominions. . . . And where is the Prince who can afford so to cover his country with troops for its defense as that thousands of men descending from the clouds might not do an indefinite deal of mischief before a force could be brought together to repel them."

Air Traffic Control. Pilots are beginning to complain about the multiplication and lack of uniformity of airport traffic regulations. One pilot on a cross-country trip was bawled out three times for unintentionally breaking some local rule. It is a nuisance to be compelled to carry and refer to a stack of books and pamphlets describing a different set of regulations at each place a pilot wants to land. Roger Wolfe Kahn suggests a remedy—"*Less Literature and More Signs.*" Reduce the variables of which way to turn, where and how to taxi, where to locate the wind direction, etc. to a few signals (like warning signs on highways) and display those to the approaching pilot. There are lots of good ideas *like* this in aviation but nobody does anything about them.

Air Speed Indicator. With the season for intensive flying at hand, all instruments should be carefully checked, particularly the air speed indicator. Students check their landing glide with the speed indicator and if it is in error, trouble might follow especially in a rented airplane. It might be advisable to have your air speed indicator checked by a good instrument man.

"Safe" Airplane. The word "safe" is a dangerous one to use in connection with an airplane because it often will induce a pilot to take chances. A "safe" airplane does not make a safe pilot. A "stuffed" cloud may exert the same magnetic attraction on a "safe" airplane as on a Jennie. But the so-called "safe" airplane may have advantages other than safety which should make it attractive. These advantages may be more important than safety for the progress of aviation.

Two great factors retarding private flying are lack of utility and cost and inconvenience of learning to fly, with which is associated the costs of requiring continual checkouts for landing if the pilot does not practice flying constantly. Therefore, anything which will increase the utility and/or cut down the cost of learning should help aviation.

If by a "safe" airplane we mean one that requires less skill to operate, or one in which mistakes can be made with less chance of serious accidents, more people will be induced to fly because obviously it should cost less and take less time for them to learn. Some of the money now spent in learning to master the difficult or dangerous phases of flying, could be spent to better advantage in acquiring very much more important cross-country experience.

The common conception of a "safe" airplane includes a tricycle undercarriage or its equivalent. We know that a great many accidents occur on the ground due to taxiing and poor visibility from the pilot's seat. No one questions that visibility from a cockpit of a plane with a tricycle undercarriage, is far superior to the conventional type.

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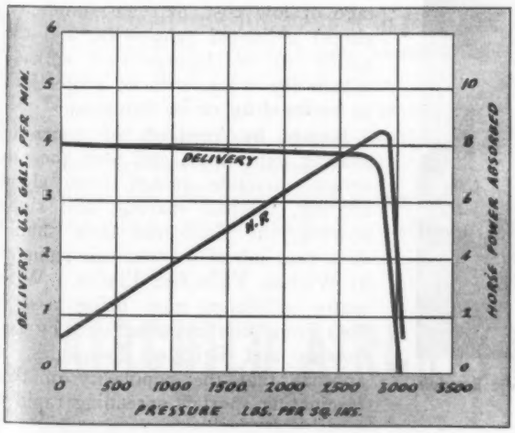

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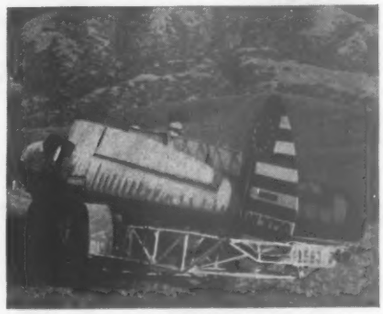
Soaring On West Coast

(*Continued from page 35*)

The short-comings of soaring were tragically illustrated on the lower ridge, however, when two pilots collided in mid-air and received injuries which proved fatal to them both. The unusual accident took the lives of Paul Sanderson and George Palmer, both well-known and well-liked members of the sailplane fraternity.

In many respects the meet contributed to further knowledge and experience in handling such a contest. Checking of performances was well organized, and arrangements for winch launching were just about perfect. All arrangements were under the direction of W. B. Klemperer, president of the Southern California Soaring Association; and detailed management was in the hands of Major Ray Cooper, manager for the association. Victor Saudek served as contest chairman, and Jay Buxton worked throughout the meet as winch operator and starter, alternating with Paul Hepburn, association secretary. More than $1,300 in prize money was contributed by various organizations in and around Kern County and the meet paid its way, largely as the result of paid attendance on the part of some 5,000 members of the general public. Two goal prizes that were not won were for flights to Delano, a little more than 50 miles north, and to Los Angeles, about 75 miles south. Three pilots got over the treacherous Tehachapi Ridge, a mountain chain rising to a height of 8–9,000 ft. between Arvin and Los Angeles, but once over the hump they were soon forced down far short of the goal.

Notable technical contributions to sailplane design were made by several builders. The Bowlus Super Albatross mid-wing sailplane was flown in competition for the first time and won the meet by a narrow margin from the Ross-Stephens "Zanonia", a sailplane of well proven capabilities



Woody Brown's champion Bowlus shown loaded on its trailer.

flown by John Robinson. The Bowlus two-place training sailplane also made its public bow for the first time and was well received. Two other two-place sailplanes were active, the "Cherokee" designed and built by Stan Hall and now a bit on the obsolete side, and the new "Brown Bomber" brought to Arvin by Allan Essery, of San Diego. This plane was, in many respects, the sensation of the contest for it finished in sixth place despite the fact that the pilot took a full day out to make his private glider tests. Definitely on the heavy side in appearance, not to say a bit awkward looking, the Essery sailplane has commodious accommodations for two pilots side by side. The performance of this plane mystified the spectators for it soared right along with the best of them. Using a pair of nearly standard Bowlus wings, the Essery sailplane carried its added load with ease and seemed quite virtuous in its general conduct. For this plane Essery won the AOPA award for design excellence.

Still another fine plane was the new Briegleb taper-wing sailplane which walked off with the high-altitude prize and might have done more but for the fact that it was used by a number of pilots and so was kept close to the soaring site, not attempting any distance flights. Of the 26 sailplanes on the field, 12 were of Bowlus Baby Albatross type and all of these planes performed well. Various other new designs made brief appearances and will probably be seen again later to better advantage after a preliminary period of testing.

One contribution to soaring unveiled at the meet, and one which shows real promise of aiding cross-country thermal soaring, was the McReynolds-Barnhart pneumatic-thermometer thermal sniffer. This apparatus was test flown by Don Stevens, with a Baby Albatross, and showed great promise. Operating on the principle that the volume of a gas, at constant pressure, varies with the temperature, the McReynolds-Barnhart instrument balances the pressure of air in two containers, on opposite wing tips. Any slight variation in temperature is quickly registered in a "U" tube on the instrument board to which the air reservoirs are connected by small copper tubing. The instrument is a development of a sensitive thermometer recently patented by Edward Barnhart. For thermal sniffing it has the advantage of low cost, extreme simplicity, almost unlimited sensitivity, and the ability to be incorporated entirely within the wing, without projections to create drag or be damaged.

Backed by hundreds of hours of soaring experience, and with the all-around practice gained from cloud soaring, thermal soaring, and slope soaring, the California boys should do a real job of soaring this summer at Wichita Falls and Elmira. With many sailplanes now being assembled from kits manufactured by the Bowlus and Briegleb companies, it appears that the popularity of this fascinating sport is spreading rapidly.

Before flying started each morning the pilots gathered for a meeting with Vic Saudek (at right, with back to camera). *Aviation photo.*

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On either count, Fairchild compels the attention of the man who tempers enthusiasm with foresight. When you buy a Fairchild "24" as a new plane, you pay less for it than you do for any other plane in its class. No other four or five place ship offers so much for so little, as any careful comparison of specifications will abundantly and conclusively prove.

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Recent Books

THE AVIATION BUSINESS, *by Elsbeth E. Freudenthal.* Vanguard Press, New York. 325 pages. $3.

Several writers have ridden to fame by debunking an industry. Apparently Miss Freudenthal had such an idea in mind when she wrote this book, but in the process she got so mad at all of us in aviation that her book is not the shrewd analysis of the industry that she hoped it would be.

She is described on the book jacket as a security analyst with long experience in Wall Street. Her book is a history of aviation in this country, written from a financial viewpoint. While the book contains a great deal of valuable information which has never before been collected together in one place, it could hardly be called an impartial history.

In wading through the vitriolic pools of the book, this reviewer kept asking himself, "What the hell is biting this woman?" Something obviously was gnawing at her vitals. All through the book there is an undertone of resentment. She is sore at practically everything that ever happened in American aviation, except the cancellation of the air mail contracts—she thinks that was swell. She is sore at the big companies because they are big, and at the little companies because they are little and have to sell out to the "monopolies". Miss Freudenthal is griped at the engine companies because there are not more of them and because they don't make diesels. She believes that Pan American Airways is air imperialism and is harmful. She seems to disapprove of exporting aviation equipment and, in fact, of allowing any manufacturer to make profits. She names plenty of names, and yours may be on her roster.

Then, almost at the end of the book, the basic reason for her resentment gushed out: in an emergency the aviation industry cannot be trusted. It should be completely nationalized. The government should take it over!

Once the reader has this clue he can go back over the book and appreciate the financial facts it contains and the vast amount of research that has gone into it. It is a book that will be seen on many aviation bookshelves this spring.

AERIAL PHOTOS—HOW TO MAKE AND SELL THEM, *by Claud J. Dry.* The Aircraft Directory, Athens, Ohio, 67 pp., $1.

This is a timely subject, but one which cannot be adequately encompassed in the space of some 60-odd pages. It is useful, however, for the photographer whose interest in aerial photography has just been awakened, and will serve as a stepping-stone to more technical reading when he has progressed to that point.

SKY ROADS, *by Ernest K. Gann.* Published by Thomas Y. Crowell Co., New York, $2. 123 pages.

Ernie Gann is a pilot with American Airlines. Apparently he had this book in his system, and he ought to feel better now because it's a good book. If Ernie flies as well as he writes we'd check him out as O.K.

"Sky Roads" is primarily a book for youngsters who want to know more about the airlines. But it provides so much readable information for adults too, that we predict thousands of copies will be swiped by air travelers if American puts them in its Douglases along with the current magazines.

The book contains an interesting story of how airplanes fly, what instruments are used and what purposes they serve, information on the weather, maintenance, and manufacturing, but the bulk of the book tells what pilots do and what they have to know to get an airline pilot's job. A splendid collection of photographs, drawings and charts adds much to the book. If your girl's kid brother heckles you with aviation questions, loan him a copy and at least you'll have peace while he is reading it.

AEROSPHERE, *Edited by Glenn D. Angle,* Aircraft Publications, New York, New York, $15

One of the most complete illustrated directory books on aviation throughout the world has recently been published. The total of 1,420 pages has been subdivided into four sections: "World's Aircraft Engines," "Modern Aircraft," "Statistical Section" and an "International Directory."

Great emphasis has been placed on the thoroughness of the engine section and innumerable photographs and cross-section drawings have been used to supplement the written description. The descriptions include pertinent specifications of the engine, and the types described are listed alphabetically. Over 1,200 designs are included in this section which total approximately 3,000 models with 1,524 illustrations. As is indicated, engines from all countries are described, including several historical models. Also included in this section is an index and tables giving tabulated specifications of the engines.

The second section of the book, entitled "Modern Aircraft," contains descriptions of planes listed alphabetically by countries. The descriptions besides giving specifications contain information on construction, standard equipment, instruments, performance and engines. Many photographs of the planes are included, a total of 379 pictures. 721 models of 217 manufacturers in 26 countries are described.

The "Aircraft Statistical Section" contains aviation records, U. S. Government appropriations, foreign and domestic "service stations," schools, etc. This section should come in handy when compiling figures on aviation.

The last section of the book is an alphabetical listing of firms and organizations engaged in aircraft activities. This section is also very complete and should be a great help in locating manufacturers in foreign countries.

Window Shopping

(*Continued from page 75*)

The following catalogs or trade literature may be obtained by writing direct to the manufacturers listed:

The Amphenol News—A monthly folder in loose-leaf style, dealing with phenolic products, especially in connection with electronic applications. American Phenolic Corp., 1250 Van Buren St., Chicago, Ill.

Bulletins 153-154-155—Strain Gages and Extensiometers. Valuable pamphlets for the test engineer. Baldwin Southwark Division of The Baldwin Locomotive Works, Philadelphia.

Safety Equipment—A 136-page catalog called the most comprehensive thing of its kind ever published. Covers everything for protection of the man and his machine. The Boyer-Campbell Co., 6540 Antoine St., Detroit, Mich.

Index for Moly Matrix, 1934 through 1939—A valuable index to the monthly publication dealing with Molybdenum steels. Climax Molybdenum Co., 500 Fifth Ave., New York, N. Y.

Speaking of Endurance—A beautifully prepared and illustrated 12-page folder dealing with Dumore electric motors used on aircraft for flap and landing gear operation, etc. The Dumore Company, Racine, Wis.

Storage Battery Power — March, 1940 — A monthly magazine of about 16 pages, devoted to the field of storage batteries in industry. Edison Storage Battery Division of Thomas A. Edison, Inc., West Orange, N. J.

GEA-2924 — Inductor Type Dynamometers. GEA-3198A—Glyptal to prevent weld spatter. GEA-214D; 1157C; 1265D; 2592A; 2618A; & 104B—Electric heaters and thermostats. This is a valuable set of General Electric data sheets covering subjects indicated in the titles listed. Write for them by numbers given above. General Electric Co., Schenectady, N. Y.

THE MEN WHO KNOW AVIATION BEST

Choose Continental Everytime

Continental's Famous "A" Series
Red Seal Aircraft Engines

"My Aeronca with its dependable Continental Red Seal Engine adds both speed and pleasure to my business," says Lloyd Spainhower, official photographer for Chicago and Southern Air Lines, Inc. The photograph shows Mr. Spainhower with Chicago and Southern's maintenance inspector Charles Feuchter at the end of a smooth, fast and economical business trip from Chicago to New Orleans and back via St. Louis, Memphis, and Jackson.

The "A" series Continental Red Seal Engines from 40 to 80 HP with either carburetion or mechanical fuel injection (an exclusive Continental feature) are standard or optional equipment on Aeronca, Culver, Luscombe, Piper Cub, Porterfield, Rearwin, Stinson, Taylorcraft, Welch — and with smooth, dependable performance dominate the 40 to 80 HP field.

Continental FUEL INJECTION

1 — Positively eliminates carburetor icing.
2 — No failure due to water in gasoline.
3 — Smoother, more dependable power in every maneuvering position.

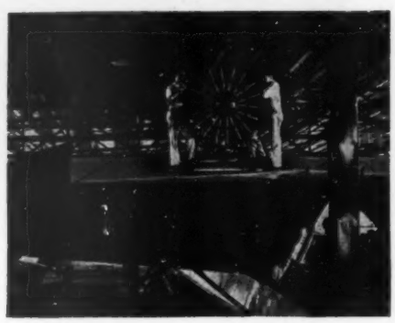
Continental Motors Corporation
Aircraft Engine Division
MUSKEGON, MICHIGAN

Mr. Bruce Braun (left), Vice-President of Chicago & Southern Air Lines in charge of operation, discusses personnel problems with Mr. Oliver L. Parks, President of Parks Air College and Mr. Willis D. Gremp who is nearing the completion of his Professional Flight training at Parks. The group is seated in one of the new 21-passenger Douglas Airliners which C&S put in service May 1st.

According to Mr. Braun, "Nothing in the operation of our airlines is given greater attention than the character and training of our personnel."

Above—Final check-up of two-way radio equipment before installation in plane.

Below—Parks Air College students getting practical training in engine installation.



Because Aviation Progress Depends on the Human Element

PARKS Leadership Training Is Designed to Develop Your Own Abilities

The human element in aviation is of such vital importance that it has attracted the attention of financiers as is shown by a recent article in the *Wall Street Journal* which says that "air line operation depends most on the human element" and that "well trained personnel is of first importance." Realization of this fact has caused the industry to adhere to the highest standards in the selection of new personnel.

Thus, you who are considering aviation as a career must be sure that your training not only will meet the requirements of the industry, but that it will develop your own honest ability and efficiency. Only through training of the character and thoroughness offered by Parks can you qualify yourself to take advantage of future opportunities for advancement.

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Section AV-6

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Please send me details of four major courses in commercial aviation training.

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PARKS AIR COLLEGE East St. Louis, Illinois

The Law May Get You

(*Continued from page 39*)

stationed to protect the crowd. The court said that inasmuch as the defendant had brought this concourse of people together for purposes of gain to itself, it owed an active duty to such persons of guarding them from injury by such means and measures as reasonable prudence and foresight would suggest.

The court said that "it would be readily foreseen that an aviator might err in his judgment or because of lack of care result in the failure to check the machine before it got off the court or to guide it in a straight line to keep it in the confines of the alighting space. . . . The dangers attendant upon a swerving of the machine in its landing is most apparent and people crowding and rushing in is also foreseeable. Regardless of what might cause the machine to swerve from its course, the defendant was bound to foresee the dangers of such use."

III. *To Pilots Rightfully Using the Airport,* the airport proprietor or manager must exercise ordinary, reasonable and prudent care to keep the premises, namely the runways, danger signal, lights, markers, etc. in a safe condition for the activities known and anticipated by the owner.

This duty is in many ways similar to the duty imposed upon the airport proprietor as to the public in general but is much narrower in scope because in dealing with pilots their knowledge and previous experience with airports must be taken into consideration. Ordinary conditions which may be dangerous to the public may not be so, as far as the pilot is concerned. In fact in the few cases that the courts have decided on this point, the courts refused the pilots recovery because, though admitting that the airport proprietor himself was negligent, the court found the pilot contributorily negligent, thereby automatically disqualifying him for any award.

In *Read vs. New York City Airport, Inc.,* 259 N.Y.S. 241 (1932), the plaintiff, an airplane pilot, damaged his plane as a result of his colliding with a truck stationed on the runway, standing unattended. The court ruled that the airport proprietor had a duty to keep the runway free from obstructions, as far as possible or to place markers where required to warn pilots of danger. But at the trial the pilot admitted that if he had looked to his right he would have seen the truck, that he merely gave a casual look and did not look to the far end of the field. Thus admitting that the airport proprietor may have been negligent, the court also found that as a result of the plaintiff pilot not carefully scanning the field he was contributorily negligent. The court denied the pilot any recovery for his damaged plane.

In *Davis vs. Oshkosh Airport Inc.,* 252 N.W. 602, the plaintiff flying his plane approached defendant's airport and in landing he was blinded by the sun and struck a hay rake on the runway. The court ruled that even though the defendant airport may have been negligent in not keeping the field clear, the plaintiff was contributorily negligent in landing when his vision was obscured by the sun and thereby could not see the rake. The court denied the plaintiff any award.

IV. *To Employees of Tenants and Employees of the Airport,* the airport proprietor must exercise ordinary, reasonable and prudent care to keep the premises in a safe condition.

This duty is similar to the one that is owed to the public in general but much narrower in scope. Like the airplane pilot the employees' knowledge of the airport and general conditions at the airport will be taken into consideration and it may well be that where the court will allow a recovery to a member of the "Public in General" class it might deny a recovery to an employee on the ground that the employee is contributorily negligent. What will constitute contributory negligence depends upon the knowledge of the employee concerning the defective condition and the precautions taken by him to avoid the accident.

V. *As To Tenants Renting an Entire Hangar,* as to the hangar and the space covered by it, i.e. areas wholly in the control of the tenant, the airport proprietor should have no obligation to keep the premises safe or to remedy any defects existing at the time the hangar is leased or at any time during the lease. In other words for any damages sustained by anyone inside the hangar the airport proprietor should be immune from liability. The reason for this is that, not having control or supervision of the premises, the courts should refuse to hold the airport proprietor liable. But if a hidden defect exists and is known to the airport proprietor at the time the lease is written, then the proprietor should be liable. But in that case knowledge of the danger must be proved.

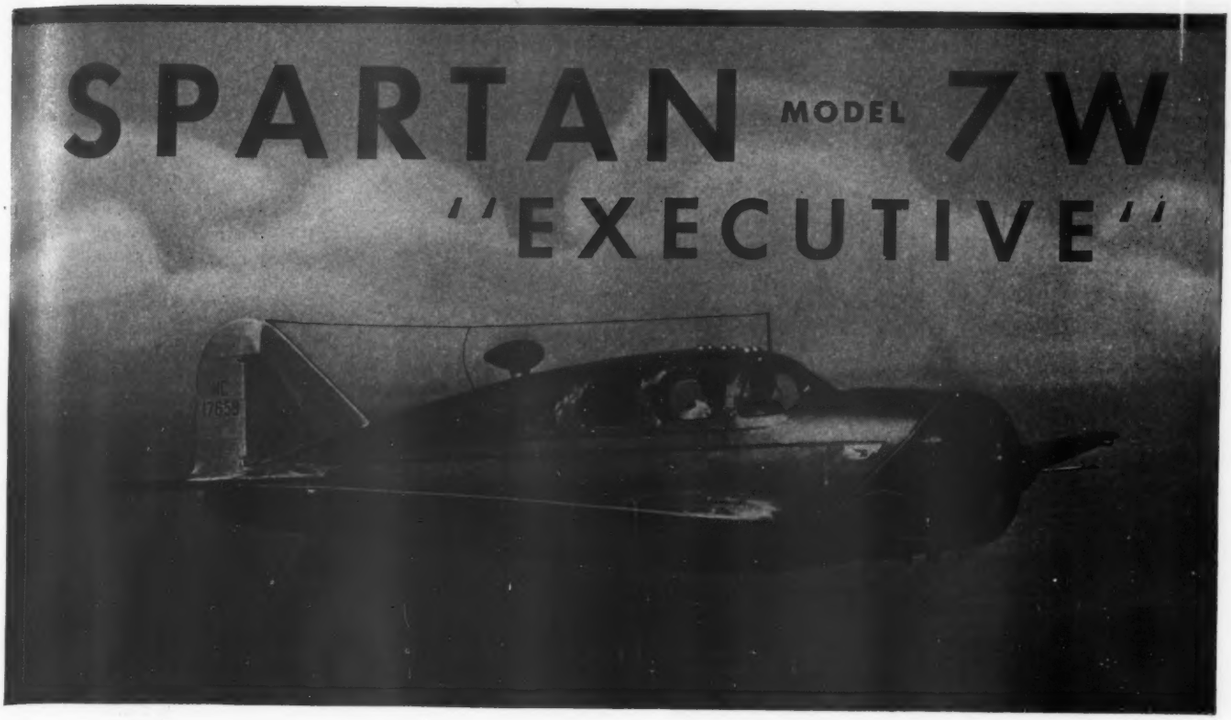
VI. *As To Tenants Renting Space in a Hangar and As To All Tenants Renting an Entire Hangar,* in respect to common areas of which the airport proprietor has full control, and which the tenants must use, the airport proprietor is obligated to use ordinary, reasonable, prudent care to keep the common service areas in a safe condition for the activities and operations known or anticipated by him. This applies to restaurants, comfort stations, landing fields, runways, signal devices, markers, approaches to the field, lights, etc.

This duty, like the duty to pilots, is similar to the duty owed to the public in general but is much narrower in scope. Tenants renting space at the airport would naturally be acquainted with the terrain, with the runways, with lights, markers, obstructions and demarcations, and the administration buildings and its facilities, i.e. restaurants, comfort rooms, etc. In fact, this duty may even be narrower than that owed to the visiting pilot because of a tenant's greater familiarity with the airport facilities. The duty owed by an airport proprietor will thus vary depending upon the class of people dealt with and the knowledge that class of people has concerning the airport, its terrain, runways, etc. It is at this point that the factor of contributory negligence plays heavily against the plaintiff.

In *Imperial Airways Ltd. vs. National Flying Services Ltd.*—Kings Bench Div. 1932 (England), the plaintiff, a tenant, sued for damages sustained to its plane as a result of its plane falling through a cover over a concealed stream running across the middle of the airdrome. A red flag was placed at one danger spot but where plaintiff's plane was damaged there was no marker. The plaintiff pilot assumed the rest of the airport was in good condition. The court ruled that the airport proprietor was under a duty to see that the field was safe for use and under a duty to give proper warning of any danger the proprietor knew of or ought to have known of. The court awarded damages to the plaintiff.

In *F. Hilles Sons Ltd. vs. British Airways Ltd.,* 1936 the plaintiff

(*Turn to page 110*)



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This five-place single-engined low-wing monoplane is the latest production of Spartan Aircraft Company, Tulsa, Okla. Designed for private and commercial use, it incorporates the latest features making for speed, safety and reliability.

NORMA-HOFFMANN PRECISION BEARINGS are employed in the control system, hinges and pulleys of the ship itself, and in the Pratt & Whitney Wasp Junior SB Engine.

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There is a NORMA-HOFFMANN PRECISION BEARING for virtually every aircraft application—108 series and over 3000 catalogued sizes—for engines (including superchargers), engine accessories, control mechanism, instruments, radio apparatus, cameras, and landing field equipment. Write for the Catalog. Let our engineers work with you.

NORMA-HOFFMANN BEARINGS CORPORATION, STAMFORD, CONN., U.S.A.

(*Continued from page 108*)

garaged its plane at the defendant's airport. The plaintiff was given space in front of a mail plane. In order to get out the mail plane to make a scheduled flight, defendant rolled out plaintiff's plane in front of the hangar. Two gusts of wind caught the plane and damaged it. The court ruled that under the weather conditions defendant was negligent in taking out the plane and awarded the plaintiff approximately $1,250. The defendant was held liable despite the fact that there was no charge for the hangar space or any rent paid for it.

In *Transcontinental Airport of Toledo, Inc. vs. Clarence E. Ogden,* 41 Oh. App. 203 (1932) the plaintiff directed his manager to store his plane at the defendant's airport because of zero weather. Without plaintiff's authority the defendant airport allowed a third party to "test" the plane and fly it. The plane was wrecked. The court awarded the plaintiff a verdict of $9,200, the value of the plane, on the ground that the defendant airport owed the plaintiff the duty when plaintiff stored his plane there not to authorize anyone to fly it except the plaintiff.

In *City of Blackwell vs. Lee* 178 Okla 338 (1936) the plaintiff sued the City of Blackwell for loss of his plane which was burned at the city's airport. The plaintiff proved that the airport was maintained by the city and that the plane burned as a result of the negligence of employees of the city. The court held that the city was liable and awarded the plaintiff $1,500 in damages.

VII. *To Passengers on Sightseeing Flights,* where the airport proprietor sponsors the pilot and shares profits with the pilot, the airport proprietor owes the obligation to such passengers to make reasonable inspection to see that the airplane used is airworthy and reasonably safe and to supervise its operation.

This duty is an affirmative one and requires the airport proprietor to take active steps to see that the plane is airworthy. It is the type of duty which requires active supervision to prevent any operative negligence. However, if an accident occurs solely because of the pilot's negligence, which the airport proprietor could not foresee, then proprietor is not liable.

In *Boulineaux vs. City of Knoxville,* 995 S. W. 2nd 557, plaintiff was injured as a result of a sightseeing trip. The plaintiff sued the airport proprietor for negligence and on the further ground that safety belts were not provided. The court found that the accident occurred solely because of the pilot's negligence. The court ruled that the airport proprietor owed the plaintiff an active duty to make reasonable inspection to see that the plane used by the pilot was airworthy and reasonably safe, but that where an accident occurred due to the negligence of the pilot which the proprietor could not foresee then the proprietor is not liable.

In this case the proprietor sponsored the pilot and shared profits with him. The court also ruled that the airport proprietor owed no duty to provide safety belts where there is no stunting.

As To Passengers on Sightseeing Trips where the airport proprietor and his employees operate the planes, the airport proprietor owes the passenger the highest degree of care to see that the plane is airworthy and reasonably safe and that the pilot is a competent and able operator.

VIII. *As to Trespassers,* the Airport proprietor does not owe any duty to maintain the premises in a reasonably safe condition but must merely be free from gross or active negligence. By trespassers is meant those not rightfully on the field or not entitled to be there.

This duty is probably the least burdensome to the airport proprietor. The reason why the airport proprietor does not owe the trespasser a duty to keep the premises reasonably safe is because he has no reason to anticipate his presence. However, once becoming aware of his presence the airport proprietor cannot spitefully become negligent thereby causing the trespasser damage. In other words, the proprietor cannot become grossly or actively negligent. If the trespasser can show gross or active negligence then the airport proprietor can be held liable. The same rule applies here as does to trespassers of private property.

After this review we can merely add "God Help the Airport Proprietor."

Tomorrow's Light Plane

(*Continued from page 37*)

be entirely unaware of its presence. If he makes a right turn or left turn, the wing drops down in front of his eyes like a billboard, making it impossible to see if he is running into another plane which might have been running along parallel, a little above his wing. This item of *vision* is, today, the greatest danger of the small plane—much more so than engine stoppage, fire risk, or spins, and is the first thing that must be corrected. A window in the top of the cabin is not enough. The pilots, in some way, must be gotten out ahead of the wing. *That plane which has the maximum vision will be the safest to fly.*

Very shortly radio will be required for these small planes at passenger transport terminals. These sets are coming rapidly, and as volume increases they will be available at prices that will make them practical for all ships. One of the greatest influences of the small ship will be its volume of instrument possibility, so that firms will feel justified in spending money to develop much simpler flying instruments and controls than are now being built. The private owner will never afford 50 instruments on the dashboard—four should take care of all his requirements. What these four will be, I cannot say, but automatic horizon, bank-and-turn, etc., must be combined in one instrument at a cost of around $10 before we can consider the instrument phase at all solved. Blind flying is impossible with the instruments now furnished, but, of course, these pilots are not going to fly blind for a while. Eventually, however, if the plane is to be of any use to him, he must be able to fly above the overcast, to go places out of sight of the ground as transports do now.

The airplane propeller, from the engineering standpoint, is probably the least advanced of any part of the private-owner ship. Wooden propellers eventually will not be suitable. Metal propellers at present are too expensive. Adjustable pitch propellers are out, for the low-cost market. Just what will come eventually in these fields cannot be said, but many things will come for the private owner.

That firm which first solves these problems and gives these owners what they want at even lower costs than present prices will certainly go to town in a big way.

SSSHHH!
at 200 miles an hour

WACO PRESENTS THE AIRISTOCRAT — TOPS IN "SPEED-LUXURY" PLANES

● All the comforts of home—in the air! The Airistocrat presents hitherto undreamed-of luxury in planes of this power class.

Deep, restful cushions, fine automobile-like interior finish, freedom from vibration, ample room for five persons, biplane construction for more ease in flying and landing, vertical downward visibility. Those are just a few of many features.

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THE remarkable safety record established by airlines of the United States during the past year, has been due, in no small measure, to carefully planned and systematic maintenance procedure.

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NEW RCA 3-BAND AIRCRAFT RECEIVER

Model AVR-7H with Provision for Directional Loop

WEATHER? Direction? *Position?* Here's the ideal 3-in-1 aircraft receiver . . . RCA-engineered and CAA-approved . . . to bring you *all* the answers. It tunes any station in the 190-420 kc. Range and Weather Band; the 495-1400 kc. Broadcast Band; the 2300-6700 kc. Communication Band. And with the new RCA Loop Attachment, available shortly, the AVR-7H will take accurate *bearings*—for direction-finding and homing.

It's equipped with a Beat-Frequency Oscillator to make range-finding and course-following effective when the signal sags into the noise-level. Crystal-control provision for any two frequencies in the communication band permits "lock-in" by approximate tuning—the advantages of fixed tuning plus the advantages of variable tuning. Automatic Volume Control when desired for broadcast and communication bands. Multi-purpose RCA tubes for maximum performance without extra weight. Iron-core I.F. and R.F. transformers. A stage of high-gain R.F. plus two stages of I.F. amplification for extreme sensitivity. Complete shock-mounting—and light, compact yet rugged construction.

CAA-approved for airline use, the RCA Model AVR-7H is ideal for private flying, airline feeder service, or transport ships. Write for complete data and descriptive literature.

For dependability, it pays to use RCA RADIOTRONS.

RCA

for Aviation Radio

RCA Manufacturing Company, Inc., Camden, N. J.

A Service of the Radio Corporation of America

Airport Fire Fighting

(*Continued from page 43*)

two hose-reels, in addition to carrying hand portables. Several trucks have been ordered since the La Guardia Field truck was commissioned.

Personnel Training

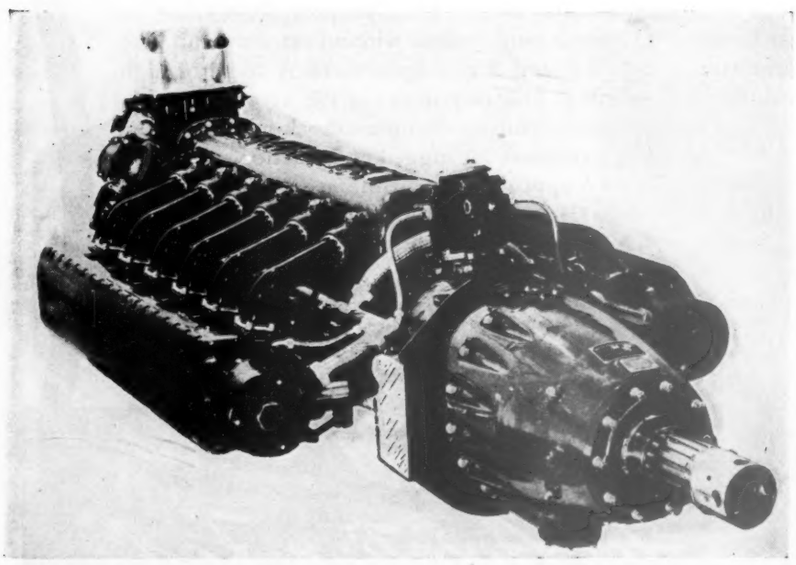
No amount of first-aid fire-fighting equipment by itself can eliminate fire losses: personnel must be taught how to use it, and must be drilled for emergency action. Along these lines is the comment of William Maxfield, System Maintenance Superintendent of TWA:

"We have set up a complete system of fire fighting in our organization by assigning each person on duty to a fire station. These stations consist either of manning an extinguisher, moving planes, opening or closing doors, as the case may be. Also a system of signals has been arranged so that with the sounding of fire signals, each person has a definite idea as to the location of the fire and the duty he is to perform. This system functions very satisfactorily and is a big asset in airport fire protection.

"An important point that we stress in our instructions to all personnel is that ordinarily damage to surrounding equipment in a fire is oftentimes equal to or greater than the damage caused by the fire when either water or damaging chemicals are used to extinguish the fire. Therefore, we have instructed our personnel to consider each fire encountered as being an individual problem, and that the selection of the type of extinguisher used is very important and will be determined by the location and type of fire encountered.

"In training all new hostesses, we use one-half day of their training period instructing them in the proper use and effects of the Lux model fire extinguisher as used in all of our airplanes."

The latest design in helicopters was designed and flown recently by Igor Sikorsky. With the lift relying upon one large three bladed 28 ft. diameter rotor and two 6 ft. 8 in. diameter horizontal rotors the ship was taken to 30 ft. in its test hop. The torque of the large rotor is counteracted by a vertical 6 ft. 8 in. diameter prop revolving in the vertical plane at the tail. The controls are arranged so that conventional movements of the stick and pedals change the pitch of the three tail props and produce the same results as those in a light plane. Power is supplied by a 75 h.p. Lycoming motor.



Into the high powered liquid cooled engine field comes a revolutionary 12 cylinder engine from Lycoming. Designated as a "flat" engine because of the horizontally opposed cylinders, six on a side, its 1200 horsepower is developed with a weight of 1325 lb. a displacement of 1230 cubic inches, being only 37 inches high and 44 inches wide. The Air Corps has been cooperating in the development and is undoubtedly very much interested.

At The Fair

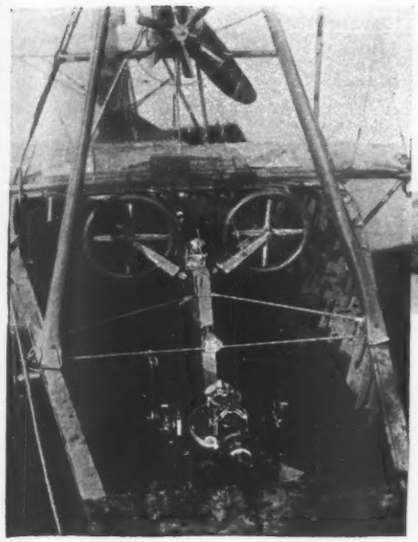
(*Continued from page 33*)

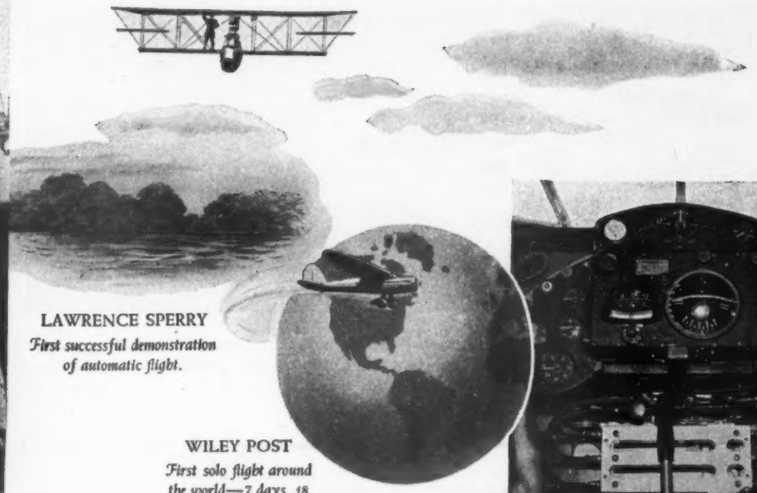
line activities are shown. A Link trainer demonstration is also part of the show.

A feature which is sure to be one of the hits of the Fair is the model airline. Visitors may be whisked direct from the Aviation Building to La Guardia Field in airline limousines where they will be taken for a flight in Douglas transports around Westchester county, parts of New Jersey and Long Island, with a fine view of New York City. These trips should acquaint thousands of people with the pleasure and comfort of air travel.

Engine, propeller and instrument companies have their newest and flashiest merchandise on hand. Crowds never fail to marvel at the complexity of a cutaway engine, or at the precise operation of aircraft instruments.

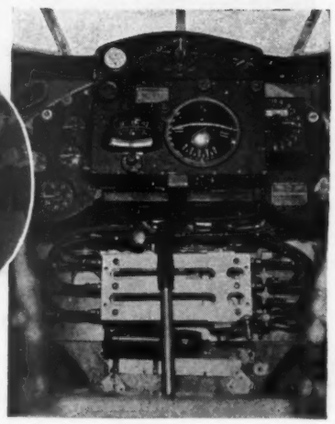
With this splendid aviation show, the Flying Forties are getting off to a fine start.





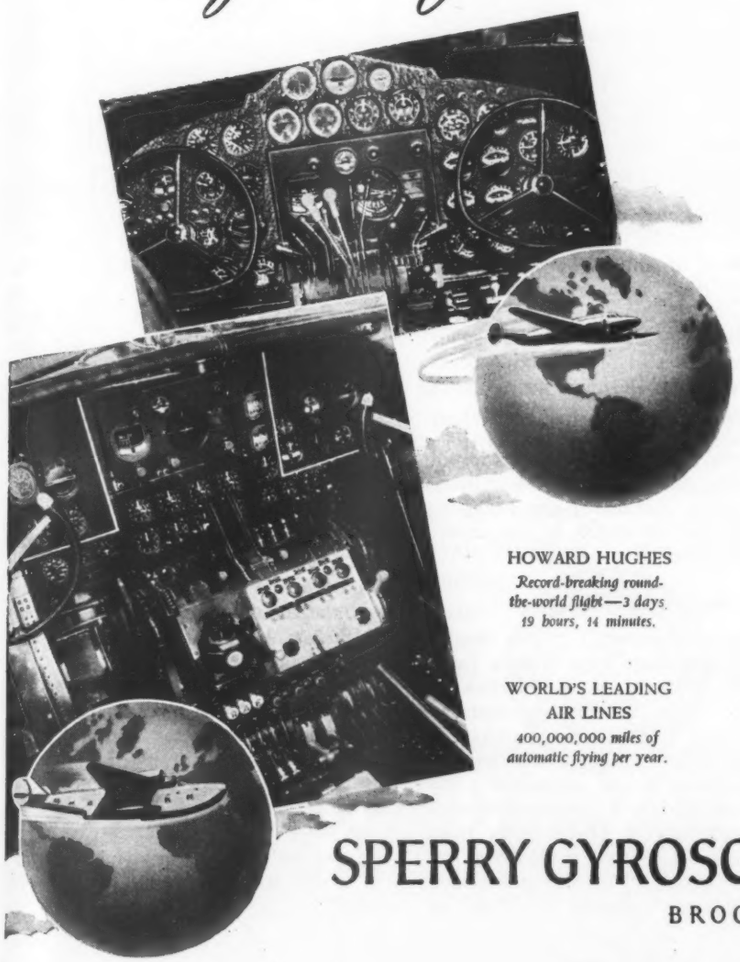
LAWRENCE SPERRY
First successful demonstration of automatic flight.

WILEY POST
First solo flight around the world—7 days, 18 hours, 49 minutes.



The SPERRY GYROPILOT

25 years of continuous improvement



HOWARD HUGHES
Record-breaking round-the-world flight—3 days, 19 hours, 14 minutes.

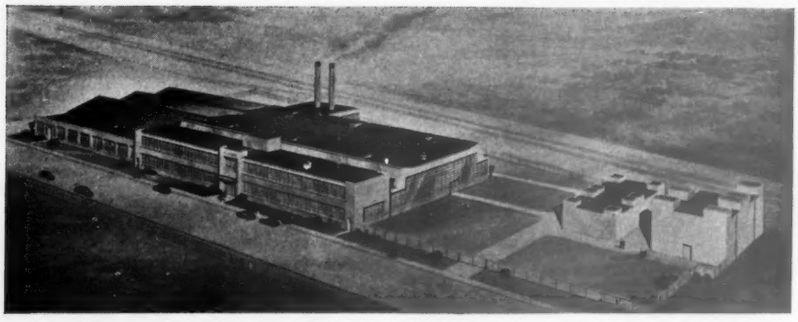
WORLD'S LEADING AIR LINES
400,000,000 miles of automatic flying per year.

Since 1914, when Sperry gave the first practical demonstration of automatic flight control, the Sperry Gyropilot has been the subject of continuous research and improvement. Through the cooperation of the Army, the Navy, and leading air lines, Sperry engineers have studied the Gyropilot's operation during its millions of miles of monthly service. As the requirements of aviation have changed, so too has the Gyropilot been changed to include refinements and new characteristics based on its world-wide use.

In the new 1940 models of the Gyropilot are embodied the sum of these developments, accumulated during a quarter of a century of intensive research in the laboratory and in the field.

SPERRY GYROSCOPE COMPANY, Inc.

BROOKLYN, N.Y.



An architect's drawing of the new Ranger Engineering Corporation after the present expansion has been completed. The original building is the extension on the left end and the test houses are at the right.

New Ranger Navy Engine

(*Continued from page 49*)

pinion which is mounted concentrically over the quill shaft. This unit, consisting of quill shaft and pinion, floats on two roller bearings and is located axially by the meshing of the herringbone teeth with the teeth of the driven reduction gear. The latter is bolted to the propeller shaft which is mounted directly above the quill shaft on two roller bearings. A thrust ball bearing locates the propeller shaft and takes the propeller's thrust. Lubrication of the gears is by a jet from the pressure oil system.

The design of the spline on the forward end of the quill shaft presented a difficult problem since torsional flexibility of the quill was desired, plus the characteristics of a conventional universal joint, to take care of any minor misalignment between the crankshaft and the pinion gear and also to prevent the transmission of forces other than torque from the crankshaft to the rigidly-supported pinion gear. These objectives had to be achieved with a design which also eliminated the possibility of serious stress concentration on the splines. The solution has been found through the use of an involute gear spline of 30 deg. pressure angle with the splines cut at a small helix angle, which flattens out under load and gives an even stress distribution over the splines.

The propeller shaft is provided with an S.A.E. No. 30 spline and standard parts for attaching the propeller. Roller bearings carry radial loads, while propeller thrust is taken by a ball bearing.

The connecting rods are of "I" section, machined from alloy steel forgings. They are of the forked and blade type. Steel backed copper lead bearing shells are held in the forked rods, the blade rods bearing on the outer diameter of the shells between the forks. Bronze bushings are used in the piston pin end of the rods.

Accessory Drives

Protection of accessories from crankshaft torsional vibration and shock loading is furnished by the drive design, consisting of a long, hollow, flexible shaft located in the crankcase at the point of the cylinder Vee and transmitting the drive from the propeller end of the engine to the accessories at the rear, successfully isolating them from any detrimental vibrations. This shaft is carried in seven bearings and acts as a header for distribution of oil to engine bearings. It is also designed to act as a centrifugal oil cleaner.

In addition to engine accessories, the supercharger impeller is driven from the flexible accessories drive shaft which eliminates the necessity for any kind of clutch in the supercharger drive.

Supercharging Equipment

The supercharger is of the single-speed, single-stage type with a rated manifold pressure of 38.3 inches of mercury. The carburetor connects to the inlet side of the supercharger housing in the crankcase rear section, thus assuring good atomization by passage of the fuel air mixture through the supercharger. Distribution from the supercharger is through two induction pipes, each supplying one bank of cylinders. A special Y fitting on each induction pipe divides the charge equally and distributes it to two manifolds, each of which supplies three cylinders.

Lubrication

The lubrication system is of the pressure type with dry sump. A pressure pump with filters, located on the crankcase rear section, circulates oil through hollow engine shafts and cast-in passages, there being no external pressure oil pipes on the engine.

Part of the oil from the pump is fed to the accessory drives in the rear section, the main supply entering the accessory drive shaft which distributes it to crankshaft bearings and connecting rods. From the front end of this shaft, oil is carried to all drives in the nose section and into the camshaft vertical drive shafts. Thence the oil flows into the camshafts, which distribute it to camshaft bearings under pressure, and to rocker arms and valve stems by spray from holes drilled in the camshaft. Cylinder walls and piston pins are lubricated by oil thrown from the main and connecting rod bearings.

Excess oil drains from the crankcase to the camshaft housings through the housings for the vertical drive shafts at the front, or through ducts at the rear of the engine. All oil, after performing its lubricating function, collects in the camshaft housings. A double suction scavenger pump, located at the rear of each camshaft housing, is arranged to take oil from either end and return it to the supply tank, first passing it through two finger strainers.

Accessories

Standard drives are provided for all accessories, and standard mounting pads or connections are located at convenient points on the crankcase rear section. Provision is made for mounting a constant speed governor for operation of a constant speed propeller. The governor drive is located on the upper rear face of the reduction gear housing. Provisions are also made for driving two gun synchronizers, the mounting pads being located on the crankcase rear section, left and right of the center line.

A few of the other accessories that have been mounted on the engine are a non-icing carburetor and a "shotgun" type starter, the latter being the first starter of this type to be designed as an integral part of the engine.

A large expansion program is under way at the Ranger plant a photograph of which is shown at the top of the page.

SAFE FINISHES FOR A *Safety-Minded* INDUSTRY

AIRCRAFT service demands the utmost in dependable, long-wearing finishes. Sun ...wind...rain...sudden atmospheric changes ... all combine to test aircraft finishes in a way in which no other finishes are tested.

For many years, Berryloid Aircraft Finishes have met the demands of this exacting service in a most satisfactory manner. As their reputation for outstanding performance became more widely known, the number of Berryloid users rapidly increased until today Berryloid Finishes are used on 75% of all American-made planes.

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Service . . .

Photo courtesy United Air Lines

it works both ways

Air lines are accustomed to giving *extra* service — but they expect extra service too, from their equipment and their suppliers.

Because Roebling continues to meet the increasingly severe specifications of the Aviation Industry, you will find many of the nation's airliners are equipped with Roebling Wire Aircraft Products.

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Roebling Aircraft Products are available either tinned, galvanized or Stainless Steel, in regular or preformed constructions

KEEPING PACE WITH AN INDUSTRY WHOSE WATCHWORD IS PROGRESS

Make these 3 tests of the school you choose

1 **Quality Instruction.** At Boeing School of Aeronautics—with 30 top-notch instructors and with small classes for more personal teaching—the emphasis, first and last, is on quality instruction. Boeing School is a Division of United Air Lines. It is famous all over the world for sound, thorough quality instruction in the 54 subjects of its 11 Career courses.

2 **Quality Equipment.** Boeing School embraces 17 modern shops and laboratories. It is Gov't.-approved in (a) Flying, (b) Mechanics, and (c) as a Repair Station. Boeing School's shops and laboratories are equipped to the highest modern standards.

3 **Placement Record.** The graduates of Boeing School are making good in aviation's top jobs—with 43 different organizations. Most of them have good positions waiting for them the day they graduate. For example, R. T. Freng, Director of Flying, United Air Lines, says: "Last year we hired 20 graduates of Boeing School of Aeronautics—would have hired more had there been more."

And Boeing School now announces new steps to help meet aviation's need for trained men. For men 20 years old and with 2 years' college, the new Airline Pilot Course—schooling time reduced 9 months, tuition reduced $2730. For high school graduates, a $1175 reduction in tuition for the Airline Pilot & Engineering Course (24 months). In addition, 10 other career courses with thorough instruction. This school trains its flyers only with heavy, commercial-type planes, ranging from 2500 lbs. to the multi-engined transport. Don't forget—this school is owned and operated by United Air Lines, the world's most experienced airline organization.

PROMPT ACTION IS ADVISED! **To maintain small classes and thorough instruction, the number of admissions to Boeing School is strictly limited. The new Airline Pilot Course, for example, is restricted to 15 students per quarter's enrollment. So don't delay in making this coupon your first step to your career. Fill out and mail your coupon now!**

This coupon is your first step

ENROLLMENT PERIODS: JANUARY, APRIL, JULY, OCTOBER

11 CAREER COURSES One specially designed to fit your chosen field of aviation. Check the course or courses you are most interested in:

Courses requiring High School only

- ☐ Airline Pilot and Engineering
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- ☐ Air Transport Engineering
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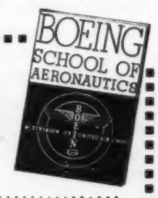
GENTLEMEN: Please mail me—without charge—the Boeing School descriptive booklet containing complete information on the school and describing in detail the courses I have checked at the left.



Name.....

Street Address.....

City.....

State.....*Age*.....

Previous Schooling.....

BOEING SCHOOL OF AERONAUTICS UNITED AIR LINES A DIVISION OF UNITED AIR LINES

Boxing For Export

(*Continued from page 41*)

stress during normal flight and ground operation. The top, sides and ends of an export case never touch the airplane. The well-engineered case must support the plane—but *the plane must never support the case*—that is important, and it is the basis of good export case design."

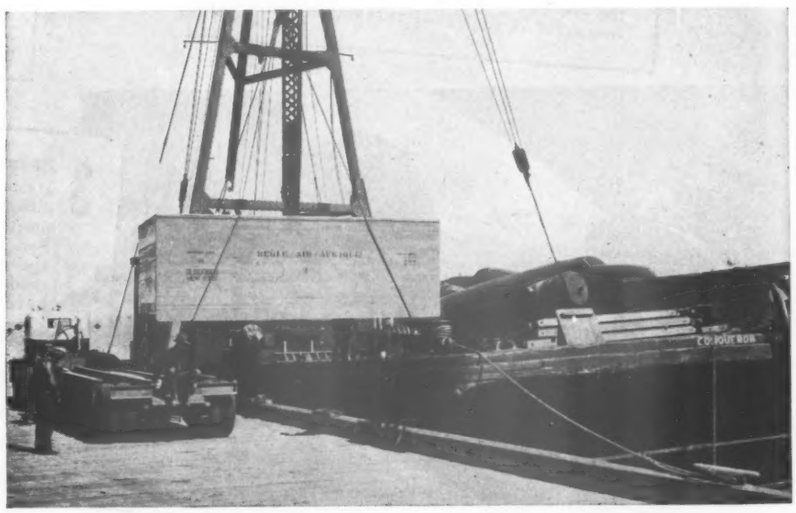
Aircraft export cases look from a distance like so many oversized piano boxes. But look at these figures and you'll see that they're made of other than corrugated board; for an airplane weighing 2 tons, the fuselage case, empty, weighs 3 tons, and the empty wing box, 1 ton. The materials that go into them vary slightly according to the specifications set down by the aircraft manufacturer. An average contract would call for fir bracing and stringers, dry spruce or N.C. pine sheathing. The ends are diagonally braced to keep the case from shifting out of square. Sides are V-braced construction to give rigid truss supports so that the case cannot warp or bend in the center. The corner posts are of double thickness to give protection against rough handling by push trucks and derrick barges. The top of the case will have waterproof paper placed between double sheathing which is nailed to strong cross-braces. The sides, ends, top and floor will be bolted and lag-screwed together for a maximum rigidity and also to make it easy for unskilled labor to take apart the case without using sledges or crowbars.

Most Eastern manufacturers have their airplanes boxed in metropolitan New York. Manufacturers on the West Coast box their light planes there and ship them by rail or water, with rail having preference because of speed. Some large planes, too wide for rail shipment, are boxed there and shipped by water. However, the majority are flown to New York and there prepared for shipment. Flying airplanes to the East Coast would seem most logical as it is faster—but the factor of insurance enters. The total cost of flying a large plane across the continent is nearly $2,000—and about one-half of this expense is insurance.

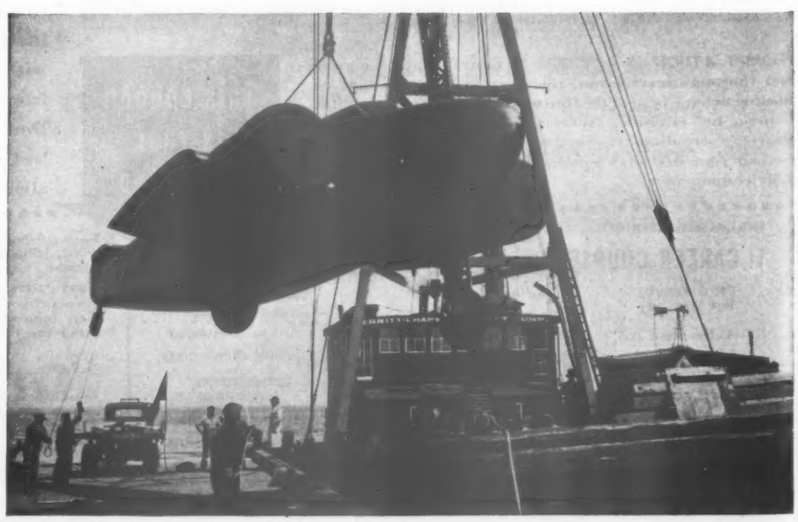
All participants usually have a voice in deciding who will box a particular export order—the manufacturer, the shipping agent, and the representative of the foreign government or airline. Much depends on the facilities available at the destination. The lack of skilled labor for unpacking prompted one boxing company to assemble its export cases with lag screws and bolts. At the destination all that is necessary is to remove the lag screws from around the top of the case and lift off the top. The ends and sides are bolted to the bottom and can be removed, still without touching the airplane. Other conditions met abroad may present problems. A recent shipment from the North American factory at Inglewood, Cal. had this requirement. Skids were to be placed on the widest side (as usual) for use on shipboard. Another pair of skids had to be placed on the narrow side so that case could be turned over onto a narrow-gage flat car for transportation to the interior of China before being unpacked.

Entering into the design and construction of export cases is the consideration of all forces to be met in loading on shipboard and during the sea voyage. It is usually known in advance where any rough treatment may be expected. The case may have to be turned almost on end to get it through small hatches for storage below decks. On a rough voyage the case may rock back and forth and sideways for days or weeks. In a rough sea, cargo may shift and crates of heavy machinery or other weight

(*Turn to page 128*)



Handling huge aircraft boxes is a job for experts. Truck on left was specially built.

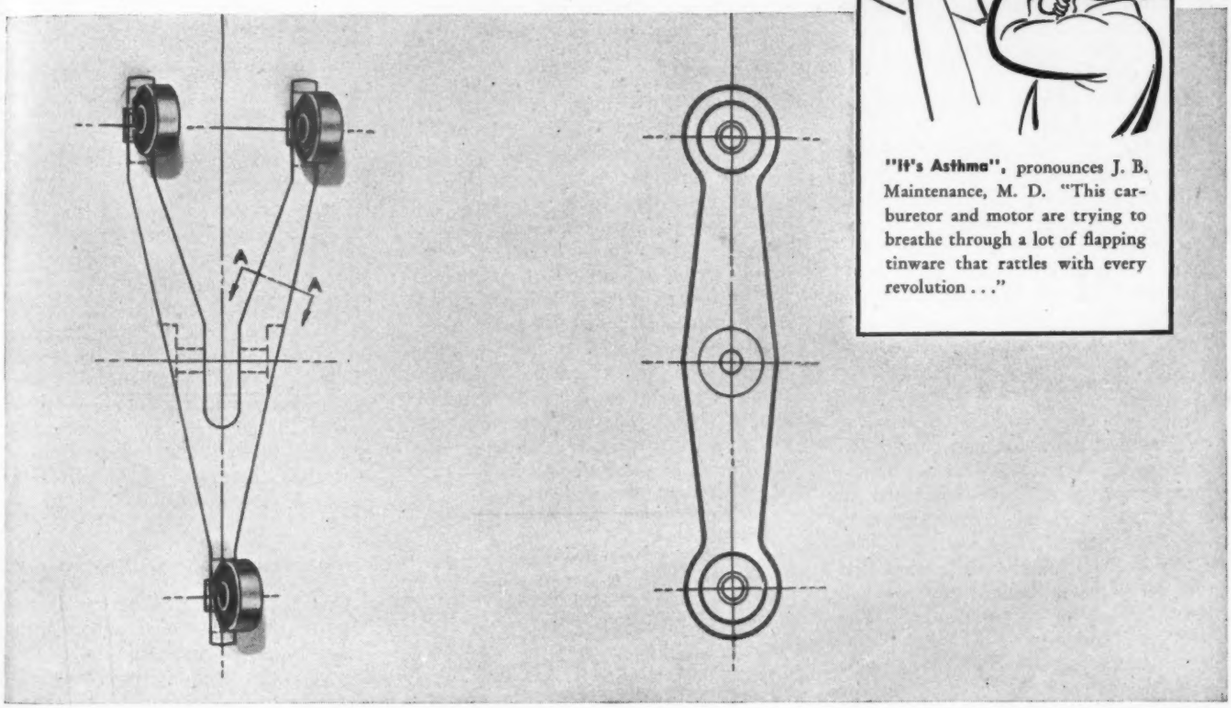


Lockheed Lodestar being loaded onto a lighter, preparatory to shipment to Europe on the Ile de France. Fuselages of this size are not boxed, although wings are boxed.

"ASTHMATIC AIR CONDITIONING"

Cured in the Blue-Print Stage!

"It's Asthma", pronounces J. B. Maintenance, M. D. "This carburetor and motor are trying to breathe through a lot of flapping tinware that rattles with every revolution . . ."

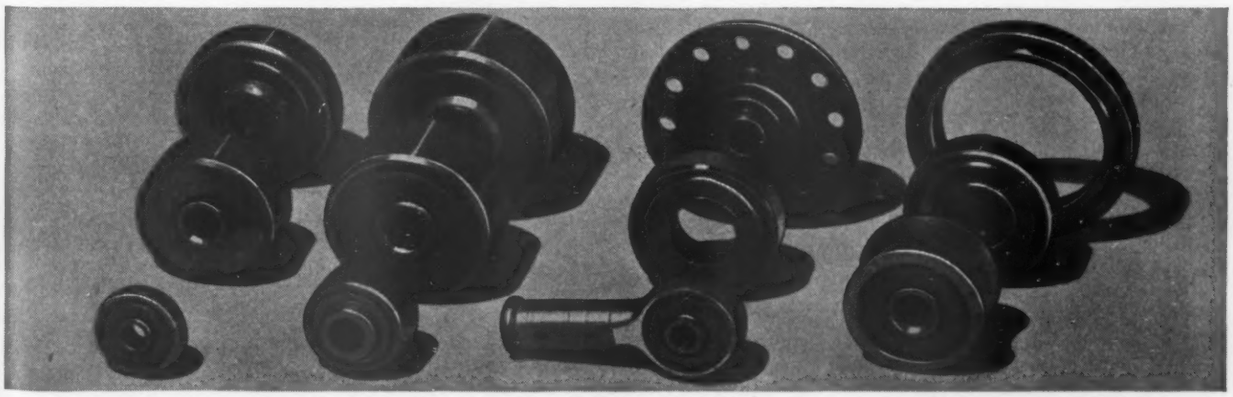


Even though the bearing loads are light, this famous builder of Army, Navy and transport ships makes sure that quality ball bearings are used in shutter controls. He specifies Fafnirs – right on the drawing * * When the pilot wants to adjust cylinder head temperature, or wants hotter intake air or cooler oil, he finds these controls easy but *positive* in action; friction-free, yet without a fraction of play that would let them "snore" in the slipstream * * You use ball bearings in your control systems so that control will be easy . . . and positive . . . *and the settings accurate.* To be sure your control systems will *stay that way,* through thousands of flying hours of heat, and cold, and constant movement, specify Fafnir Aircraft Ball Bearings, whose unquestioned quality you and all other aircraft builders have recognized for over ten years. The Fafnir Bearing Co., Aircraft Division, New Britain, Conn.

FAFNIR *Ball Bearings*

For Aircraft Engines and Controls

THE BALANCED LINE — MOST COMPLETE IN AMERICA . . .



Value Received From An Engineering Dept.

(*Continued from page 45*)

36 from the International Correspondence Schools, 30 from Los Angeles Junior College, and 22 from Pasadena Junior College.

Other institutions well represented include, Alabama, Arizona, Cincinnati, Columbia, Cornell, Harvard, Iowa, Iowa State, Kansas, Kansas State, Mississippi State, Nebraska, New York University, North Dakota, Northwestern, Notre Dame, Ohio State, Southern California, Texas, Tri-State College, Washington State, Georgia Tech, Columbia, Carnegie Tech, and Wisconsin.

No Blind Alleys

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—Fuselage
—Wing and Center Section
—Empennage
—Power and Plant Fuel System
—Landing Gear and Hydraulics
—Controls
—Electrical
—Equipment
—Armament
—Checking
—Stress
—Special Ships
—Shop Contact
—Weight Control
—Material
—Planning
—Service Engineering
—Specifications Engineering
—Process Engineering
—Production Methods
—Engineering Records

Four months later the new engineer is given another of the above. After that, he may obtain these forms upon request, although no more will be issued as a matter of routine procedure.

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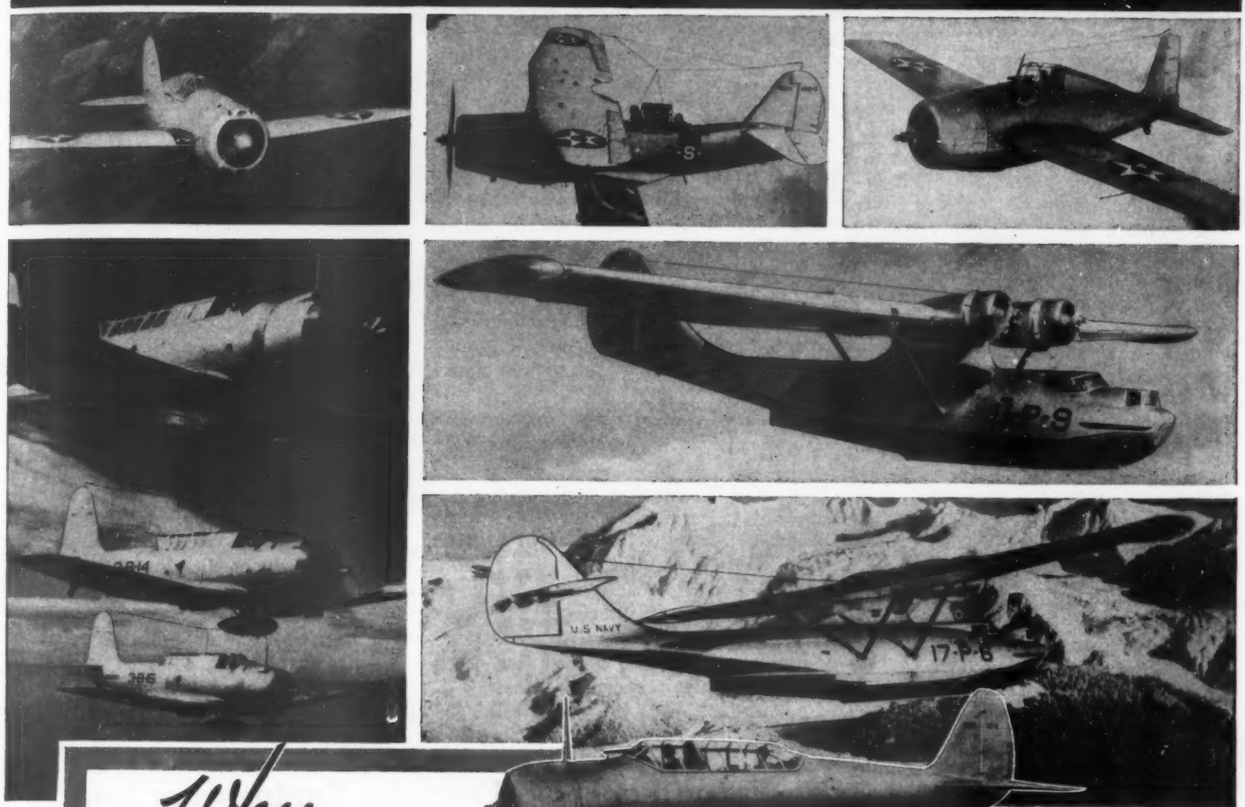
(*Turn to page 124*)

ALL EQUIPPED WITH STAINLESS MANIFOLDS



HERE ARE *a few types of ships recently added to the U.S. Navy fleet. Each is equipped with a manifolding system of lightweight stainless steel, resistant to corrosion and oxidation. U. S. Navy Official Photographs.*

Why STAINLESS?

Because **stainless is both strong and fatigue-resistant at elevated temperatures.**

Because **it produces no oxidation scale up to 1650°F., well above all normal exhaust temperatures.**

Because **it resists the corrosive attack of modern "doped" fuel products, as well as exposure to atmosphere.**

Because **it effectively resists surface abrasion at points of metal-to-metal contact.**

Because **it offers excellent fabrication qualities—for deep-drawing, bending, and welding.**

THESE are the principal reasons why leading aeronautical engineers have adopted U·S·S Stainless Steel as a standard material for exhaust manifolds and collector rings. This construction using the stabilized material, which is not subject to intergranular corrosion, has proved itself in actual service records of 7000 hours and more. Today, the stainless manifold is serving successfully as standard equipment on most of America's famous airplanes, both in civil transport and in Army and Navy fighting craft.

U·S·S STAINLESS STEEL

AMERICAN STEEL & WIRE COMPANY, *Cleveland, Chicago and New York*
CARNEGIE-ILLINOIS STEEL CORPORATION, *Pittsburgh and Chicago*
NATIONAL TUBE COMPANY, *Pittsburgh*

Columbia Steel Company, San Francisco, *Pacific Coast Distributors*
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UNITED STATES STEEL

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UNITED STATES STEEL

F-M

(*Continued from page 47*)

band region. Armstrong deliberately tossed aside this objective and used a wide swing increasing the width of the sideband region in order that another objective, reduction of interfering noise, might be achieved.

To obtain the necessary room in which to swing, he set his transmitter frequency in the ultra high-frequency region, where room was available, and where a wide swing could be obtained from a small percentage variation of the central carrier frequency. He realized that the wider the swing he employed, the fewer would be the stations which could be accommodated in a given region of the spectrum, so he struck a compromise at a total channel width of 200 kc.

The transmitter frequency lies midway between the channel limits when not modulated, and swings about 75 kc. on either side of its center position at maximum modulation, making 150 kc. swing, total. The remaining 50 kc. of the 200 kc. channel is used as a guard band against the next station. Under certain conditions the whole channel width of 200 kc. may contain essential sideband components, but in general stations may be assigned on adjacent 200 kc. channels without interchannel interference if precautions are observed.

The highest modulation frequency employed is 15,000 c.p.s. near the upper limit of audibility of the human ear. The deviation ratio, namely the swing each side of the central carrier (75 kc.) divided by the maximum modulating frequency (15 kc.), is accordingly 75/15 or five to one.

There are several methods of producing a frequency-modulated signal at the transmitter. Armstrong's own method uses a balanced modulator which develops a 200-kc. signal of fixed amplitude, but having a phase angle which varies up to 30 deg. in direct proportion to the instantaneous value of the modulating frequency. The modulating signal is, moreover, predistorted so that its amplitude is inversely proportional to frequency. When such a phase-modulated signal is passed through a succession of frequency-multiplying stages, it becomes a frequency-modulated signal. In typical cases, frequency multiplication of some 3,000 times is employed to obtain the 75 kc. deviation. The transmitter contains a great many tubes, but they are of the small, receiving tube variety. This type of transmitter has a crystal-controlled central frequency. The other type of transmitter, the so-called reactance tube type, uses a vacuum tube whose output voltage leads its output current by 90 deg., thus giving a capacitance effect, which may be varied by applying the audio signal to its grid. This varying capacitance is used as part of the capacitance of the tuned circuit of the transmitter oscillator. The frequency of the oscillator accordingly varies with the modulating signal.

Note that the frequency modulation stations require about five times (or more) the amount of ether space as would a double sideband amplitude modulated station of the same modulation capability. This is one of the superficial disadvantages of the f-m system, since ether space is at a premium. The disadvantage is counterbalanced by the fact that f-m stations are singularly free of interference from one another, so that in a given region of the ether spectrum, more stations may be assigned in a given locality without interference on f-m than on a-m. General agreement on this aspect of the subject has been granted only in recent months.

At the receiver, a superheterodyne circuit is usually employed to amplify the signal before detection. The i-f amplifier is a symmetrical 2- to 4-stage affair, constructed to pass the full channel width of 200 kc. and to offer a high gain (preferably of the order of one million times) since very weak signals may be used successfully. The detector circuit itself is preceded by a limiting amplifier which removes any variations in amplitude from the signal which may have been introduced prior to that point, but allows the variations in frequency to pass on to the detector proper.

The detector is a frequency-responsive circuit, usually called a discriminator, since it is identical with the discriminator circuit used in automatic frequency control in broadcast receivers. The output of the detector is an audio frequency voltage whose amplitude depends on the extent of the frequency swing applied to the input, and whose frequency depends on the rate at which the input frequency swings. The detector output voltage is then amplified in a conventional audio frequency amplifier and applied to the loudspeaker.

(*Continued in an early issue.*)

Value Received From An Engineering Dept.

(*Continued from page 122*)

go to every man in the engineering department.

A shop tour of the entire factory does not cover a specific picture of every department, but gives the new engineer a general idea of the entire organization and the relation of one department to another. There follows a lecture course on company time, the result of engineers coming to us from other industries who need specialized training in aircraft work.

Lectures are given to groups of these engineers, the speakers being men in the department who are selected because of their knowledge or ability in the particular subject under discussion.

Available also on a university extension basis is a series of advanced type courses given one night a week for eight weeks at the John Muir Junior High School in Burbank. The first course of the series, on "Plastic Properties of Metals," is now being presented by E. I. Ryder of the Extension Division of the University of California, who is also assistant to our structures staff engineer. We hope by fall to replace many of the present trade extension courses with university extension courses which permit advanced training. Many of these earn university credits, and all are to be given at a nominal fee.

The engineering department library contains about 6,000 separate items, all of which may be used by the engineers either at the office or at home. These include books on aeronautics, shop procedure, hydraulics, management problems, etc., as well as aeronautical and machinery magazines, N.A.C.A. publications, Army Air Corps information circulars. S.A.E. publications, and "Lockheed papers" written by members of the department, or excerpted from other technical publications.

Twice each month about 80 or 90 engineers who rate as supervisors or administrative personnel attend a dinner. Here round-table discussions and lectures enable the lead men in the department to keep abreast of all modern engineering thought by a mutual exchange of ideas.

(*Continued in an early issue.*)

The Minute

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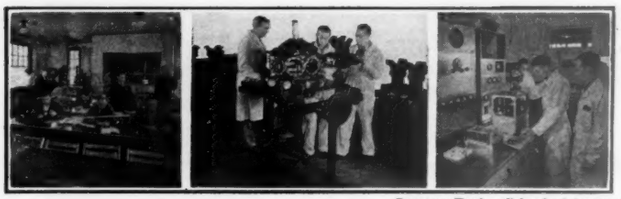

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General Aeronautics

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By Hilton F. Lusk

Director, Technical Institute of Aeronautics, Sacramento Junior College; formerly Dean, Boeing School of Aeronautics

THIS new book explains the basic fundamentals of aeronautics and their practical applications. Throughout, emphasis is placed on the information needed to pass the Civil Aeronautics Authority's examinations for *any* Pilot rating and for its Aircraft and Aircraft Engine Mechanics' certificates. No one who masters the information in this book need fear difficulty in answering any question in the official examinations. 284 questions, typical of those in the written and practical tests, are an important feature.

While designed primarily as a text for ground schools, technical institutes, and colleges, *General Aeronautics* is so clearly written that it also meets the needs of those who must study at home without an instructor.

MR. LUSK writes out of a background of many years' experience. He holds certificates as a Commercial Pilot—Instructor Rating, and as an Aircraft and Aircraft Engine Mechanic. He is an Associate Fellow, Institute of the Aeronautical Sciences; a Member, Society of Automotive Engineers.

Condensed Outline of Contents

Flight Principles: Modern theories of lift. High-lift devices: slots, flaps. Center-of-pressure movement. Aircraft drag and power required. Airplane flutter. Counterbalanced controls. Trimming tabs. Airplane balance, stability, control. Wing power loading.

Construction of Airplanes: Essential components of airplanes. Tricycle landing gears. Weights, loads, load factors. C. G. determination after adding new equipment. Stresses on plane parts; compression, tension, shear, bending, torsion. S.A.E. stainless steels. Aluminum alloys. Alclad. Riveting metal airplanes; forming labor head. Bend allowance for forming metal parts. Wood, fabric, welded steel construction. Repairing ribs. Tube, spar, cable splicing. Fabric lacing, sewing. Doping, finishing. Assembly precautions.

Airplane Operation: Piloting principles. Flight procedure. Take-off, landing. Turns. Cross-controlling. Height of "On-pylon" turns. Figure eights. Side slips. Forced landings. Flying in rough air. Icing conditions.

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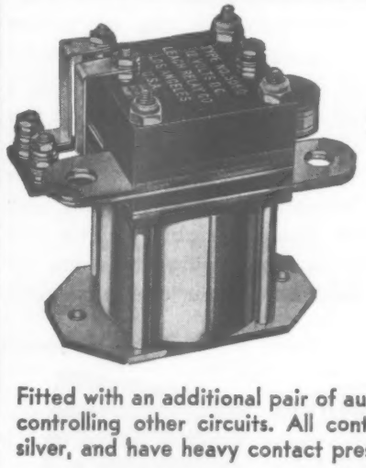

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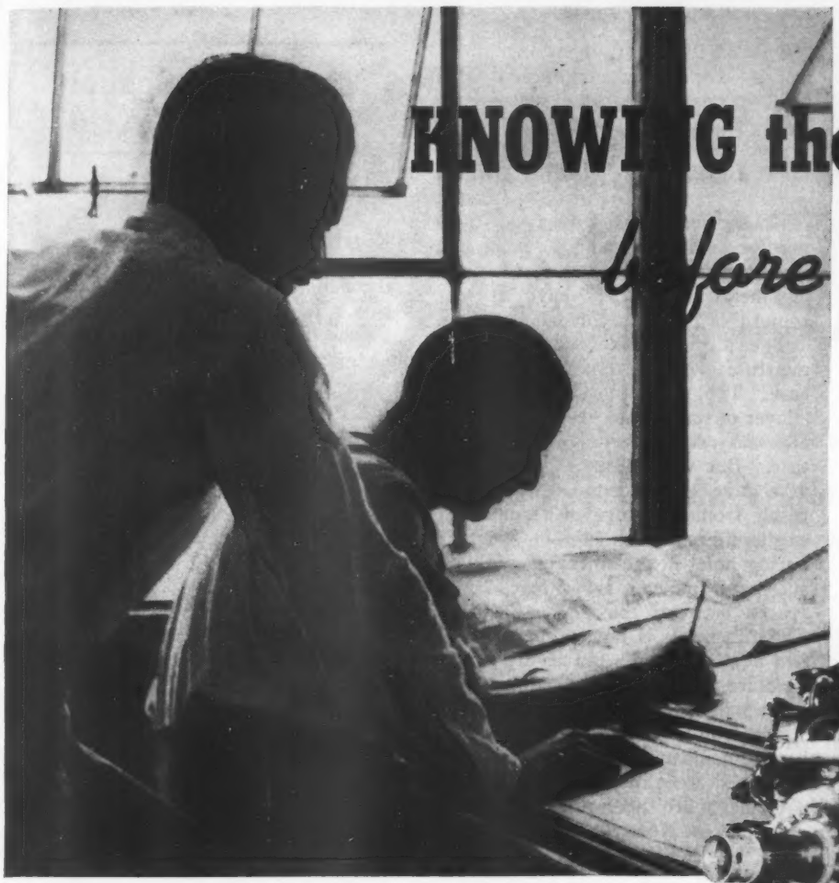

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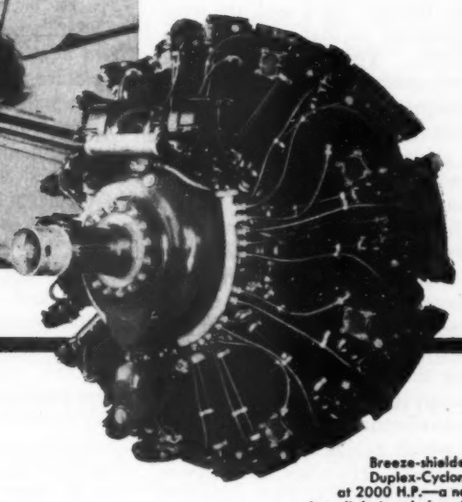

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(*Continued from page 120*)

may lean on or fall on the case, other cases may slide into it. In spite of promises from steamship lines, heavy cargo may be stored, and not evenly, on top the case. The aircraft export boxer meets these conditions beforehand by fastening the plane only to the floor of the case. Any pressure or slight damage to the sides, ends or top will not be transmitted to the plane. By this method of fastening, the case can literally be turned upside down without injury to the plane as all stress will still be centered on the normal points of stress—wings, landing gear and tail. Provision is also made so that if there should be any uneven pressure on the case (weaving), this movement will not be transmitted to the structural framework of the airplane. This is accomplished in the typical fuselage case by having the front fittings rigid and the rear fitting designed so that it may oscillate slightly. This is probably the most important development made in the design of aircraft export cases. This system of fastening is advised also for all land transportation of airplanes, whether by truck or by rail.

Although one method of export boxing has been described here fully, one that is being used by many of the large Eastern manufacturers, the boxing industry and the aircraft manufacturers are not in agreement on some points. Controversy still exists regarding the use of slings in loading boxes onto lighters and steamships. Some manufacturers supply hooks or slots in which cables may be inserted to lift cases. However, stevedores and steamship companies are reluctant to use these hooks—preferring to use their own slings, which have been pre-tested. Some aircraft boxers place angle irons on the top edges of the export case to keep the sling from cutting in. This has proven very effective.

Airplane manufacturers' specifications vary on the relative proportion of strength given to the sheathing, and upright braces, depending on the design of the case and weight of the contents. Aircraft boxers and airplane manufacturers are divided on whether sheathing should be inside or outside the uprights, and also whether vertical, horizontal or diagonal sheathing is strongest for export cases. The trend is toward horizontal sheathing placed outside the uprights so that a completely smooth surface will be had on all sides. This prevents exposed uprights from catching other cargo during loading, with possible damage to the case.

One of the most important forces met by airplanes during ocean shipment has been combated successfully but again the industry is not in agreement on the best method to use. The force is salt-laden moisture which would rust or corrode exposed metal. All manufacturers specify a moisture-proof coat for the metal. Some use an anti-corrosion grease, others paint the metal, still others have a compound that prevents corrosion or rust.

The aircraft boxer considers this moisture when designing the export case. Top, sides and ends all receive a layer of waterproof paper to keep out any stray sea water as well as moisture. But ventilation is necessary to take care of condensation that will result from a change of temperature or humidity. This can be done by boring holes in the sides, but the most successful method is to leave small spaces between the floor sheathing. Experimenting is now going on with two new substances for absorbing the moisture, one contains aluminum, the other mostly silica.

What does one of these aircraft boxing companies look like in action? A trained crew and certain specialized equipment are necessities. We can go over to Newark Airport to see some of them at work. Brewster fighters are being boxed for shipment to Finland and Belgium.

Before the first Brewster was boxed, an engineer from the boxing concern, working with the help of specifications from the manufacturer, has studied the small fighting ship and designed the fittings that will be used to fasten it to the floor stringers of the case. The dimensions for the case have been figured. Back at the boxing company's plant special jigs are set up and on these experienced carpenters pre-fabricate the floor, top, sides and ends of the export cases. These will be carried by truck to Newark as they are needed. Twelve carpenters work on these cases, with a foreman carpenter in charge. Two aircraft engineers designed the case and the fittings and will supervise the actual mounting of the plane in the export case. Four licensed airplane mechanics handle both the disassembly and the mounting. Four packers are needed to handle the small parts. Later on other men operating the boxing company's fleet of heavy duty trucks will transport the cases to piers in Jersey City or Staten Island.

Excluding the trucking, approximately 150 man-hours will go into the boxing of one plane. The crew described above can handle about six airplanes a week.

Spartan's School

(*Continued from page 64*)

oscilloscope; and a signal generator having a Piezo-Electric oscillator, utilized in making the periodic checks of aircraft transmitters required by the Federal Communications Commission. Test benches are equipped with a tube checker, latest type analyzers, meters, aircraft transmitter control heads, and adjustable length antenna for bench servicing and checking of aircraft transmitters and receivers. The above describes only a part of the equipment at Spartan School that enables the student to receive complete training in every phase of aeronautical radio.

The Air Transport Communications Course is given in a period of twelve months. The student begins with the basic fundamentals and continues until he is able to build and service complicated equipment. During the first six months he is trained for the Commercial Radiotelephone License. Subjects taught during this period of the course include basic electricity, vacuum tubes, alternating currents, microphones, audio amplifiers, loud speakers, power supply, oscillators, aircraft and range transmitters, antennas, navigation, meteorology, receivers, radio license theory, and a certain amount of code. The total time devoted to these studies amounts of 939 hours. Practically full eight-hour days, five days a week, permits a great deal to be accomplished. Theory occupies 345 hours; shop practice 596 hours.

The last two quarters include a study of airline operations, radio communications, oscilloscope, design and construction of transmitters and receivers, frequency monitors, servicing of transmitters and receivers, advanced meteorology and navigation, and code practice. Upon completion of this work, students are qualified to take examinations for a Commercial Telegraph License.

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(*Continued from page 70*)

airline offering service between these two points, United will not have to contend with any other airline competition.

Operating twin-engined, 10-passenger Boeing 247 D's, now to be known as "Sky Coaches," United, using a slower time schedule, will offer rates 25 per cent below standard rates. A fleet of 21-passenger Douglas planes will maintain regular service on the San Francisco-Los Angeles route, taking two hours for the flight and charging $18.95 as the standard fare.

The "Sky Coaches," taking three hours for the flight and making intermediate stops, will charge $13.10 for the trip, or about 3⅜ cents per mile. This would compare to nine hours as the best train time, and a fare of $17.35 for a first-class railroad ticket plus a Pullman lower berth. The train coach fare is $6.

United believes that this new airline coach schedule, rather than take away regular patrons of its first-class service, will attract a new group of customers who have never flown before.

Important precedent setting attributes may be present in this new rate innovation. With the introduction of faster, costlier and more luxurious four-motored airliners, the major trans-continentals may reduce fares and schedules on their older and slower equipment. TWA plans to place its new Boeing Stratoliners in operation this month. United and American anticipate delivery of the new Douglass DC-4 early next year. The competitive situation among the transcontinentals, however, may complicate the introduction and maintenance of varying rate schedules.

In any event, this new experiment in rate structure should accelerate the growth of air travel made at the expense of Pullman and first-class rail transportation. The progress of airline revenue passenger-miles with estimated Pullman revenue passenger-miles in recent years shows the following trend:

	Airline Revenue Passenger-Miles	Pullman Revenue Passenger-Miles	Airlines % Pullman
1935	269,958	7,146,270	3.77
1936	388,095	8,354,840	4.64
1937	407,531	9,170,428	4.44
1938	476,039	8,269,882	5.75
1939	677,673	8,500,000	7.97

It is reliably estimated that the airline ratio reached a new peak of between 11 and 12 per cent in April as against less than 7 per cent for the same month in 1939.

With such a persistent trend, it is small wonder that astute investors have been rumored to have been selling stock holdings of Pullman, Inc., and investing the proceeds in leading airline equities for the long pull.

Encouragement for commitments in air transport stocks is found in current earnings reports. Indications are that April, with estimated earnings of about $750,000, may have been the most profitable month experienced thus far by the airlines as a whole. Such earnings would boost the industry's net profit, before income taxes, for the first four months of 1940 to about $1,000,000 as compared to a net loss of $730,850 for the same period in 1939.

American and Eastern continue to account for the bulk of the good earnings being reported for the industry.

American Airlines, for the quarter ended March 31, 1940, showed a net profit after income taxes of $304,053, or $0.86 per share, on 353,320 shares outstanding. Net earnings for the same period in 1939 amounted to only $23,801, or 8 cents per share on 292,044 shares then outstanding. Earnings for the 1940 first quarter, however, included a profit of $110,025 realized on the sale of planes to Delta. The increase in outstanding stock is largely accounted for by the private sale of 50,000 shares made late in 1939. The net proceeds of $1,787,000 was to be applied toward the company's extensive new equipment purchases. American has accepted, thus far this year, and has scheduled for 1940 delivery, a total of 28 DC-3s and 4 DST sleeper planes. This is in addition to the 15 DC-4s scheduled for 1941 delivery. At that time, American may again do some additional financing to obtain funds to pay for its new plane acquisitions.

Eastern Air Lines' net profit after all adjustments, amounted to $511,579, or $1.17 per share for the first quarter of 1940. This compared with net earnings of $233,125, or $0.56 per share for the first three months of 1939. The first quarter of the year, however, generally represents the most profitable one for Eastern, as it coincides with the peak winter travel period experienced by the company. The normal seasonal decline continues to follow the same pattern, with April traffic about 18 per cent below that of March. Eastern recently entered the capital markets for funds with which to finance new equipment purchases. The company issued "rights" to its stockholders entitling them to purchase a total of 110,909 additional shares at $32 per share. The proceeds of about $3,500,000, along with current resources, should enable Eastern to pay for all new equipment commitments presently outstanding.

United Air Lines showed a net loss of $288,575 for the first quarter of this year as compared to a loss of $419,085 for the same period in 1939. Lower depreciation rates, in effect since Jan. 1, 1940, attributed to this comparative improvement to the extent of $64,825. While it was not until August that United wiped out its accumulated deficit for 1939, the expectations are that the company will be well in the black this year by June. United recently increased its DC-4 order from ten to twenty in addition to ordering ten additional DC-3s for 1940 delivery.

Transcontinental and Western Air reported a net loss of $391,458 for the first quarter of 1940, or $26,617 greater than the loss reported for the like 1939 period. Current results do not include air mail pay for the Kansas City to Chicago, Chicago to Pittsburgh, and Chicago-New York air mail routes which were granted TWA last December, since the rate of comparison is yet to be determined. The increased deficit is attributed partly to the substantial expenses incurred preparatory to the scheduled installation in service of the new Boeing four-motor Stratoliners this summer. With passenger revenues for the 1940 first quarter running in excess of 57 per cent ahead of last year, TWA, in spite of added expenses, gives every hope of finishing in the black for this year.

Originally, the major lines for 1940 anticipated a 50 per cent increase in traffic over 1939. Thus far, for the first four months of 1940, revenue passenger-miles have been about 65 per cent ahead of last year. Moreover, with the 1939 peak already exceeded in April of this year, the air transport industry is about to enter the profitable peak summer season. With such a background, the outlook for 1940 augurs well to at least attain, if not exceed, the earlier optimistic estimates of the operators.

	Barron's Aircraft Average	Barron's Transp't Average	Barron's 50 Stock Average
April 12, 1940	47.32	34.66	87
19	47.42	31.34	85
26	46.48	32.62	85
May 3, 1940	46.90	32.97	84
10	46.70	31.75	84